APRIL
1946

POWER

GENERATION, TRANSMISSION AND APPLICATION
OF ALL THE POWER SERVICES

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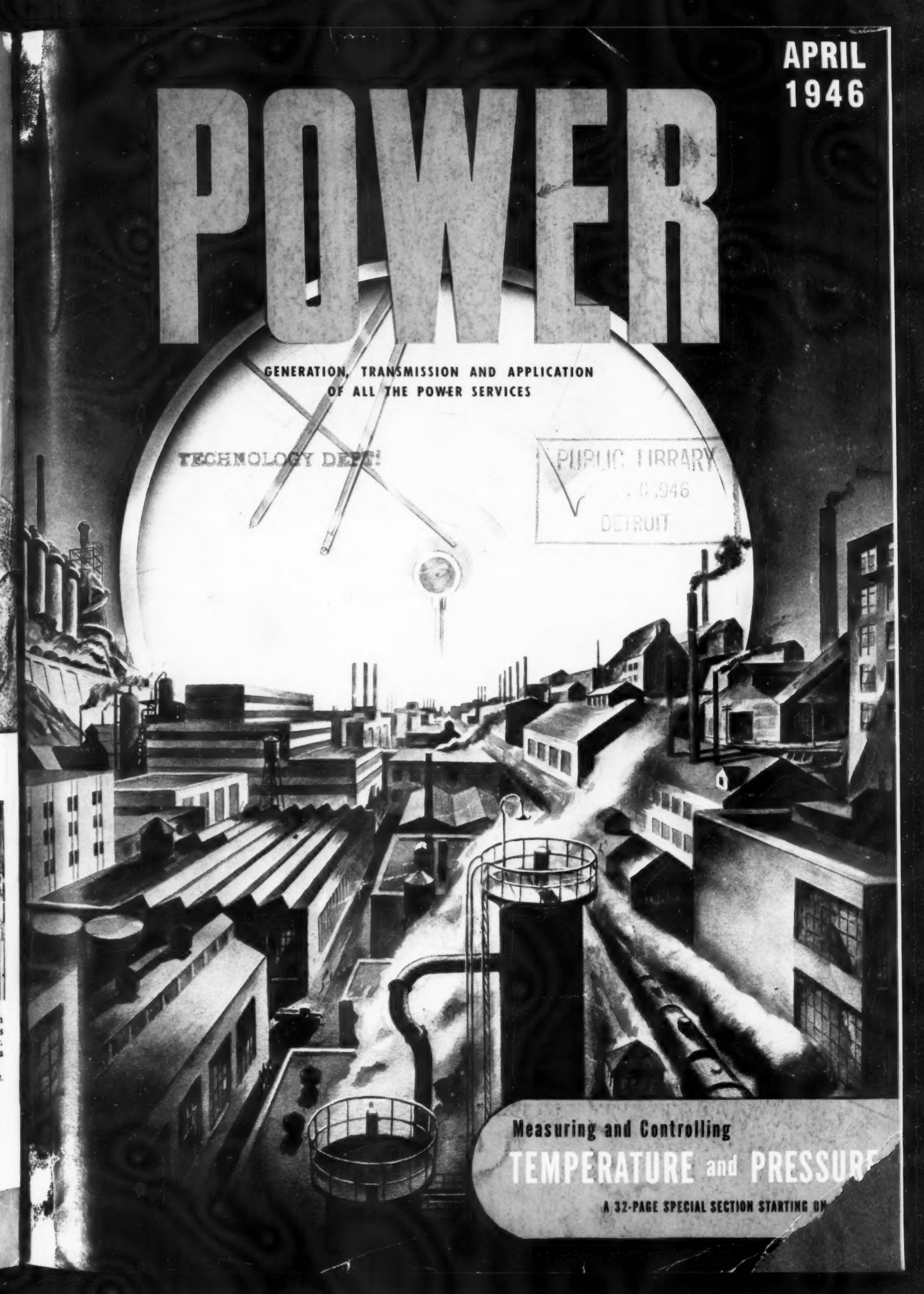

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PRACTICALLY

Every

U.S. ORDNANCE WORKS *and the* 2 ATOM BOMB PLANTS *were* HYDROJET *equipped*

Uncle Sam and the Engineers who worked for him took no chances in designing war plants. They specified equipment that could "take it" under the worst possible conditions. It is always good engineering to design and build this way. One may be lucky—and not get slag when dry ash is expected—but if equipment is specified that can handle anything that comes down, that's what our forefathers called "safe and sound." Practically every U. S. Ordnance Works and the two Atom Bomb Plants were equipped with Hydrojet Ash Handling Systems, Hydrovac Dust Handling Systems and other A-S-H products. Catalogs on request.

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which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), April, 1946, Vol. 90, No. 4. Published additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany 1, N. Y. Editorial and 330 West 42nd Street, New York 18, N. Y. Entered as second class matter, August 25, 1936, at Albany, N. Y., under the act of March 3, 1879. Printed least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 West 42nd Y. Please indicate position and company connection on all subscription orders. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 50 for one year, $5.00 for two years. Great Britain and British Possessions, 36 shillings per year. All other countries, $6.00 for one year, $9.00 for cents.

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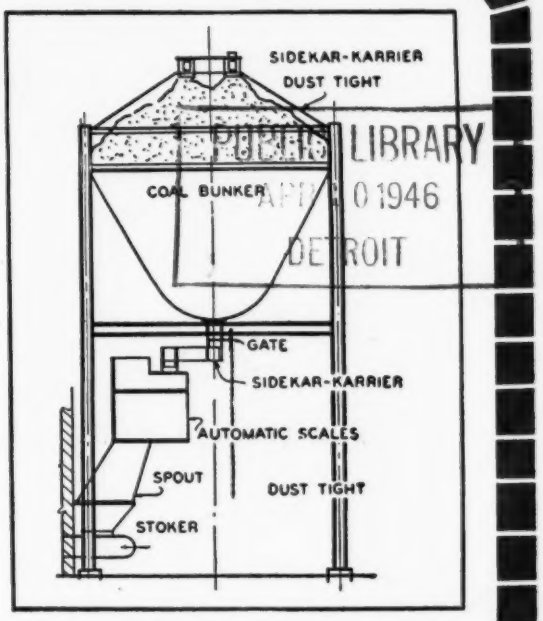
Simplicity

FEATURES THE

LINK-BELT

SIDEKAR-KARRIER

Boiler Room Conveyor



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Lower Cost—Improved Coal Handling

An effective solution to the problem of cutting boiler room coal handling costs is afforded by the LINK-BELT SIDEKAR-KARRIER "run-around" conveyor.

The conveyor design is characterized by extreme simplicity. A single strand of chain carries the buckets, which operate on rollers. Especially adapted to boiler plants equipped with overhead bunkers and stoker spouts, for the installation of individual weigh scales. Requires only one to two ft. of head room.

Other advantages: 1) Uniform feed within a horizontal path of travel, 2) Automatic discharge to several points, 3) Surplus material is recirculated in buckets until a new discharge point is found, 4) There is virtually no segregation or degradation in the conveyor, 5) Buckets and spouts are self-cleaning, 6) Less abrasion means longer life, 7) Horsepower requirements are low, 8) Conveyor is enclosed, no dust leakage. The SIDEKAR-KARRIER is adapted to a wide range of capacities and conveyor lengths.

The drawing at the top shows a typical installation of a coal bunker equipped with a dust-tight SIDEKAR-KARRIER, with a similar unit feeding to the automatic scales.

• • •

Engineering details and scope of application of the SIDEKAR-KARRIER are illustrated in Folder No. 2068, which will be sent on request.

10,242

Above — Shows idler-sprocket end of SIDEKAR-KARRIER installation handling coal.

LINK-BELT COMPANY

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LINK-BELT
SIDEKAR-KARRIER

16 B&W VETERANS AT OAK RIDGE...

MANY of them could have been honorably discharged from active service years ago—yet the imperative speed and secrecy of the atom project brought 16 veteran B&W Boilers one of the most vital, historic tasks ever assigned to any boilers in all recorded time.

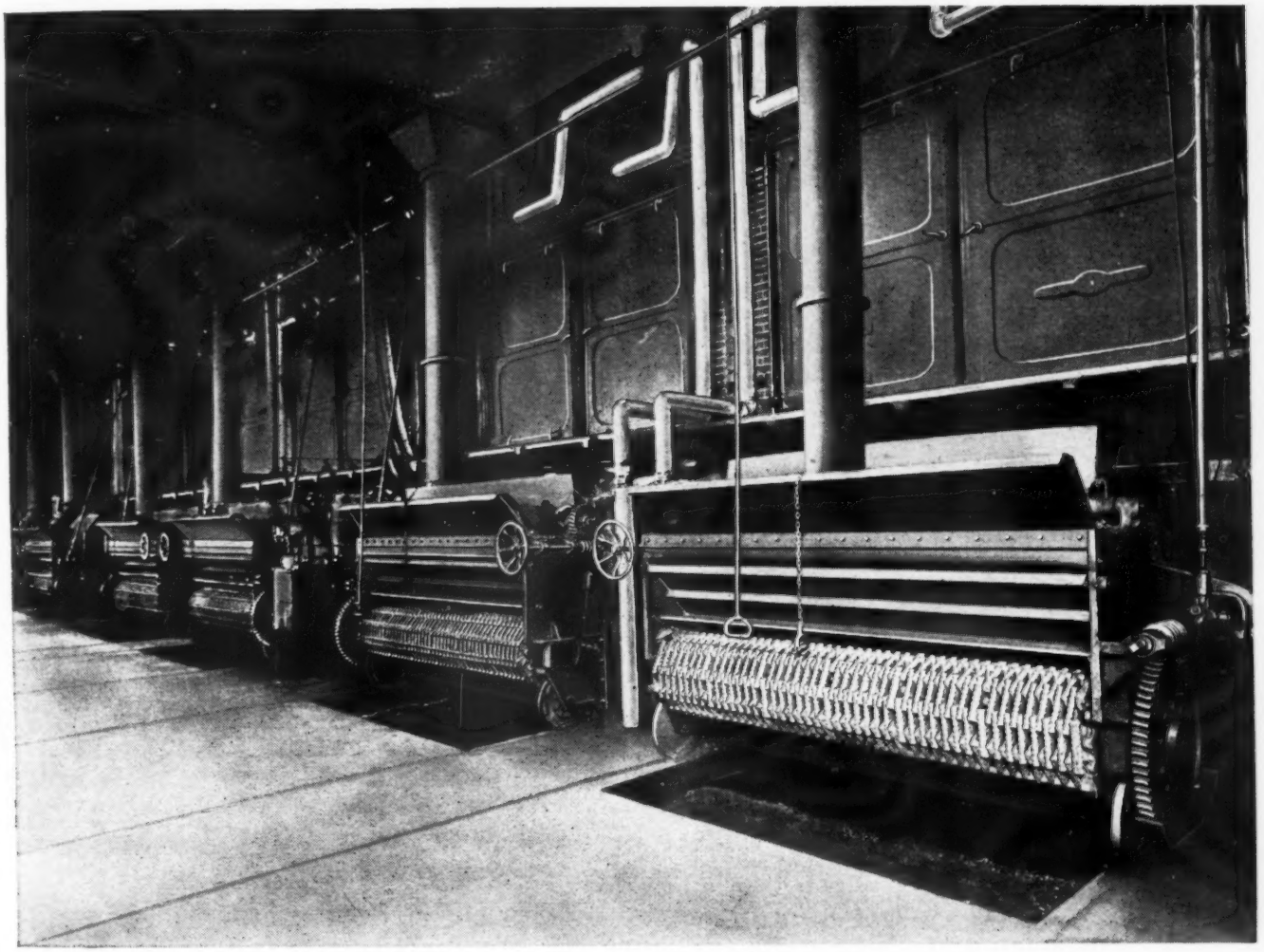
"Drafted" from sugar refineries, locomotive works, utility plants . . . from Massachusetts, Pennsylvania, New York, Kentucky, Louisiana . . . the 16 veteran B&W Boilers were reset at Oak Ridge to supply a large part of the total steam requirements for the Oak Ridge project.

In fulfilling this important assignment even after 25 to 40 years of continuous service elsewhere, these boilers are convincingly demonstrating the long useful life, lasting dependability, and operating satisfaction that B&W has been building into steam-generating units for over 60 years—and still is.

Important also to the success of this dismantling and resetting job were the long-preserved specifications of boiler details which were available from B&W records. With this information, necessary replacement parts were readily obtained to original equipment specifications, thus avoiding possible delay in getting the boilers into service.

Modern B&W boilers, too, can be relied upon for long-term satisfaction because they are the products of the same kind of sound engineering and construction that made possible the outstanding record of these 16 veteran units.

DRAFTED FOR SERVICE



Some of these B&W boilers—in service since 1904—were removed to Oak Ridge where they are giving additional years of satisfactory service.

Water-Tube Boilers, for Stationary Power Plants, for Marine Service . . . Water-Cooled Furnaces . . . Superheaters . . . Economizers . . . Air Heaters . . . Pulverized-Coal Equipment . . . Chain-Grate Stokers . . . Oil, Gas and Multifuel Burners . . . Seamless and Welded Tubes and Pipe . . . Refractories . . . Process Equipment.

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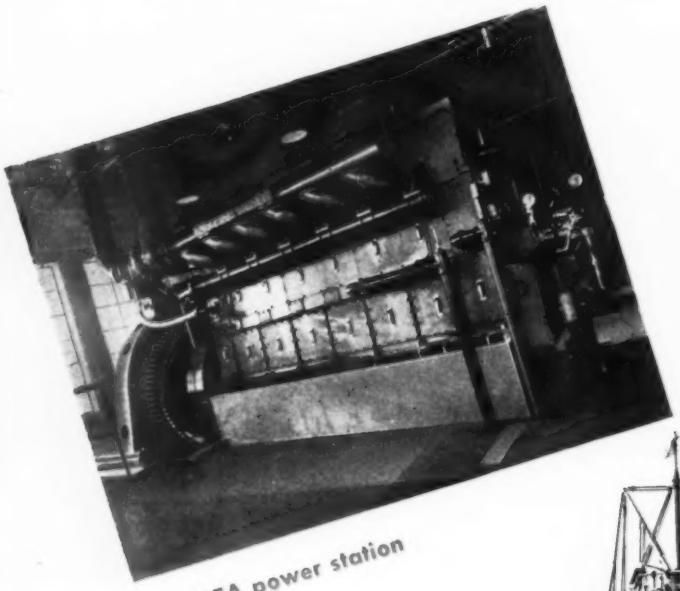
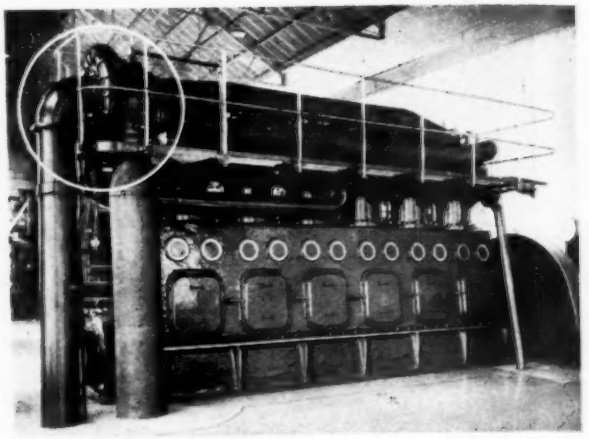
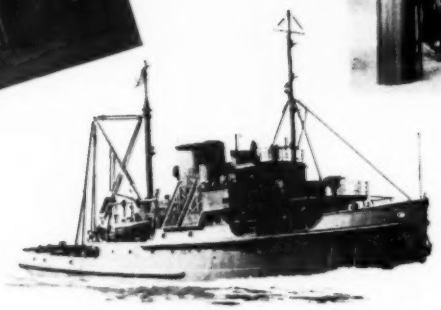


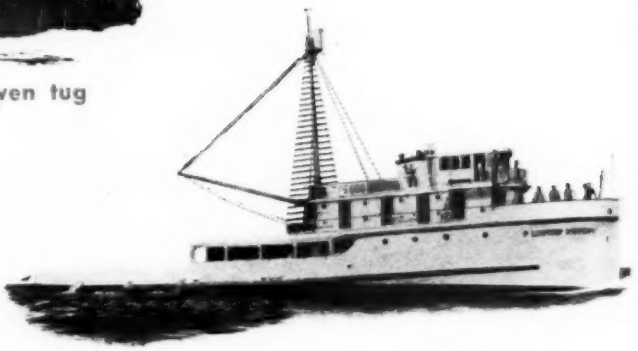
REA power station



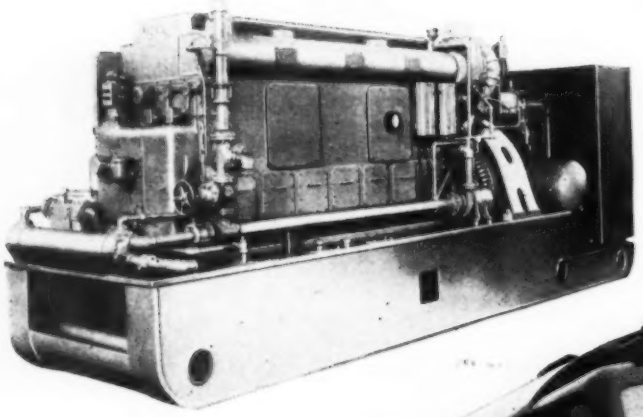
Pipe line
pumping station



Diesel-driven tug

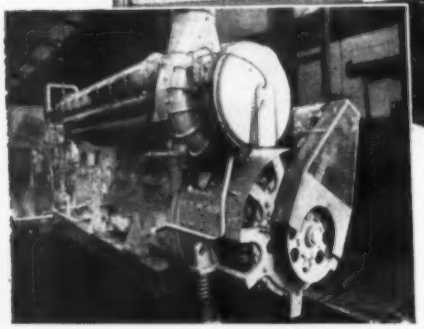


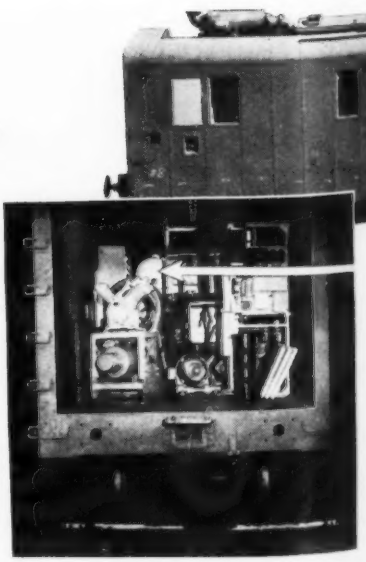
Diesel-driven
tuna clipper



Package
power plant

Diesel-electric
mainliner

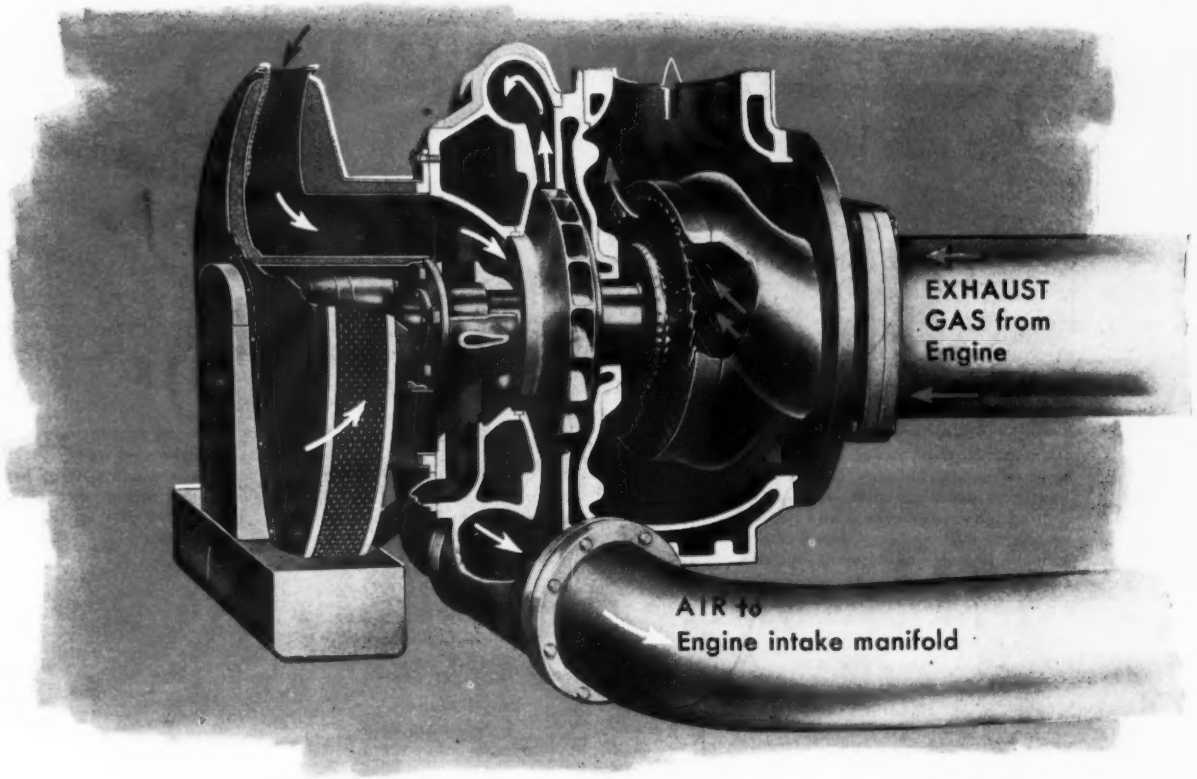




Mobile railway
power plant

ON.. ELLIOTT-BUCHI TURBOCHARGERS

boost power in all Diesel fields!



Turbocharged four-cycle Diesel engines have met with unparalleled success in widely diversified installations. Engine builders and users like their compactness and adaptability. They like the "plus" factor of turbochargers.

For the turbine-blower that does the work is driven by exhaust gas from the engine, utilizing power ordinarily lost. This hot gas has been tamed by Elliott engineers in a design that functions as dependably as the Diesel itself.

All builders of four-cycle Diesels now use Elliott-Buchi turbochargers. They are in service by the thousand. They boost power up to 50 per cent and sometimes more. They are worth finding out about. Bulletin?

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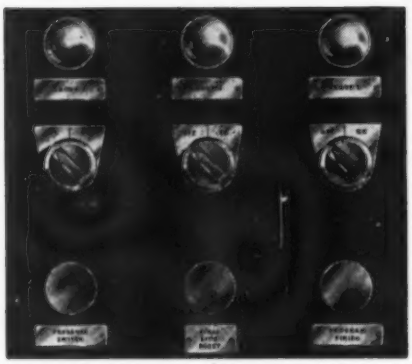
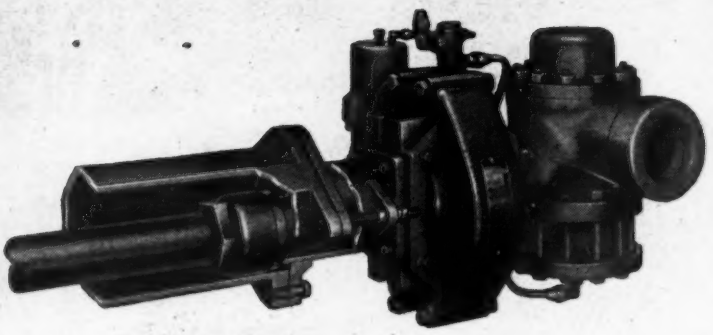
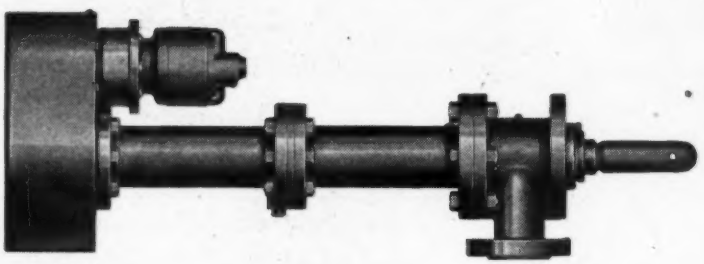
BETTER BOILER CLEANING



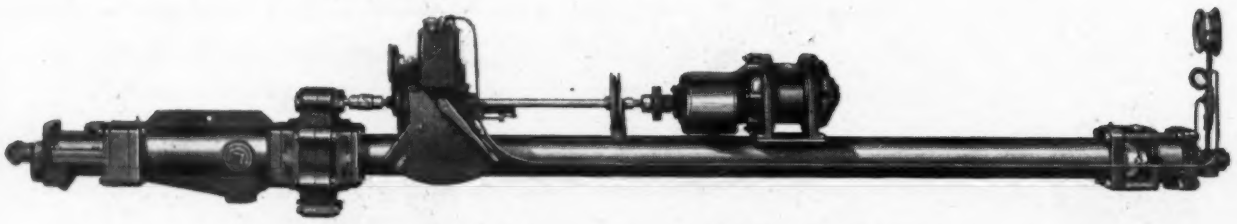
Diamond Program panel controls both fixed and retracting blowers (on boiler, superheater, economizer and air heater). Any desired number of groups can be had when system is designed, but panel shows three groups. Entire soot blowing system is operated automatically in proper sequence and at correct speed by simply pushing "start" button. Any group can be operated independently by simply throwing a switch on control panel.



Diamond "Air Puff" Soot Blower having element permanently installed inside the setting. Compressed air for cleaning is discharged from nozzles in a series of short puffs with substantial pauses between which permits use of a much smaller compressor. Air operation automatically rotates element to new position during each puff. Designed with large valve and large air passages to minimize pressure drop.



Diamond Model IF Retracting Soot Blower (at right) uses compressed air as the cleaning medium and is electrically operated.



Diamond "Telescopic" Soot Blower uses compressed air (or steam) as the cleaning medium and is electrically operated as shown; air operation also available.

RESULT FROM

DIAMOND

AUTOMATIC SEQUENTIAL

SOOT BLOWING with AIR

Soot and slag removal with compressed air instead of steam has a number of important advantages that make for lower operating costs as well as better boiler cleaning. Air eliminates the expense of boiler feed-water makeup, and saves energy from the coal pile. Air provides a dryer medium which is particularly desirable for surfaces operating near the dew point. Air is a more effective medium for slag removal because of its greater density and lower temperature. Air requires less blower maintenance on the basis of experience on installations in service since 1940. Air requires no piping insulation. Air permits better control of fly ash flow and grain loading of gas to dust collectors or to atmosphere. Air, when introduced intermittently instead of continuously, eliminates upset operating conditions during soot blowing period.

Other important advantages that are common to all Diamond Automatic Sequential Soot Blower Systems (steam as well as air) are a saving in labor and the elimination of the "human element" which assures that all blowers are operated in proper sequence and at correct blowing speed every time they are operated. Blowers can be either electrically or air operated and controlled —or a combination of both. System can be remotely operated from boiler control board or most convenient location.

Write for further information regarding Diamond Automatic Sequential Air Soot Blowing Systems that have been giving very satisfactory service on boilers as large as 900,000 lb/hr since 1940.

SPECIALTY CORP. Detroit 31, Mich.

DIAMOND SPECIALTY LTD. • Windsor, Ontario

BAILEY BOILER METERS ENGINEERED

Bailey Field Engineers backed installations adjust each Bailey Boiler

The use of Bailey Boiler Meters and Bailey engineering service for fuel conservation dates back through World War I.

Modern installations of Bailey Boiler Meters usually include Bailey Boiler Control to automatically maintain maximum fuel economy and other desirable operating conditions.

BAILEY METER CONTROL...

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHEAT

—YOUR PASSPORT TO FUEL CONSERVATION

by the know-how gained from thousands of successful Steam Flow—Air Flow Meter to the particular requirements of the unit which it serves. The meter then serves as a guide to firemen in obtaining maximum fuel conservation in everyday operation.

Bailey engineering service starts with the selection of equipment and continues through the design, construction, calibration, installation and final adjustment on the job. Much of this engineering work is done in the user's plant by Bailey Field Engineers who have been thoroughly trained in combustion and automatic control practice. These engineers are stationed in over 30 industrial areas throughout the United States and Canada for the purpose of rendering prompt "on the spot" engineering service without undue traveling expense.

The Bailey Engineer in your community has "know-how" at his command which was developed by over 25 years experience with the Steam Flow—Air Flow method of combustion control. This includes the records of tests on thousands of boiler installations covering a wide range of fuels, furnaces and fuel burning equipment. You will find that this engineer has more to offer than meters and controllers. He is primarily interested in helping you to secure maximum fuel conservation and other benefits which result from the intelligent use of correctly selected and properly applied instrumentation. G-21

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Bailey Meter Company Limited, Montreal, Canada

The Complete Combustion Control System
CONTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

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STEAM ENGINE PERFORMANCE ASSURED

THE right oil for effective steam cylinder lubrication depends on your operating conditions. Consequently, Texaco makes a complete line of steam cylinder oils — to assure quiet, efficient and economical operation whatever the steam pressure or temperature may be.

The recommended grade of Texaco steam cylinder oil atomizes completely and clings to cylinder walls. Hence, it reduces cylinder and piston wear and helps keep valve stems and rod packings clean. If steam is re-used for processing, there are Texaco oils especially designed to separate rapidly from exhaust or condensate.

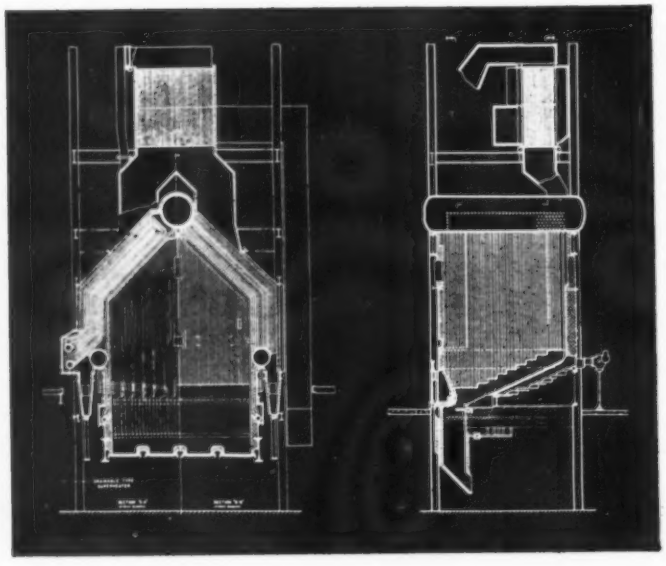
Let Texaco Engineering Service help you select the most effective oil for your particular steam conditions. Call the nearest of the more than 2300 Texaco distributing plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

STEAM CYLINDER OILS

FOR EVERY STEAM CONDITION

S-A Steam Generators
FOR SMALLER CENTRAL STATIONS, MANUFACTURING AND INDUSTRIAL PLANTS

The S-A steam generator has been developed over a period of years to meet the requirements of smaller central stations, manufacturers, and industrial plants. Desirable operating characteristics of large central station units are approached in this small, compact, and highly efficient unit. The five installations shown here illustrate adaptability to varying conditions.



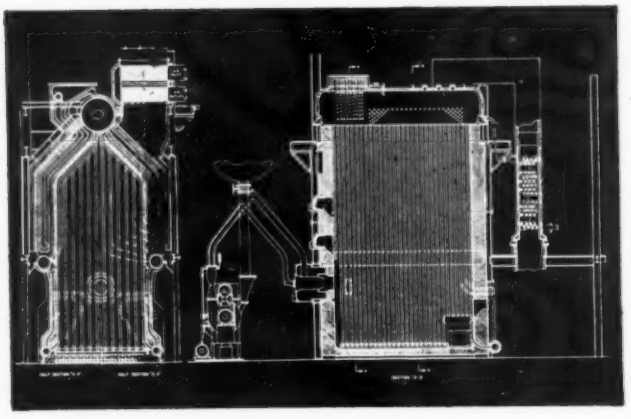
ELECTRIC MANUFACTURER

Number of Units.....1
Steam Capacity.....150,000 lb. per hr.
Design Pressure.....700 lb. per sq. in.
Operating Pressure.....650 lb. per sq. in.
Final Steam Temperature.....850 deg. F.
Feedwater Temperature .....350 deg. F.
Fuel.....Bituminous Coal
Efficiency (with air heater)....84.2 per cent

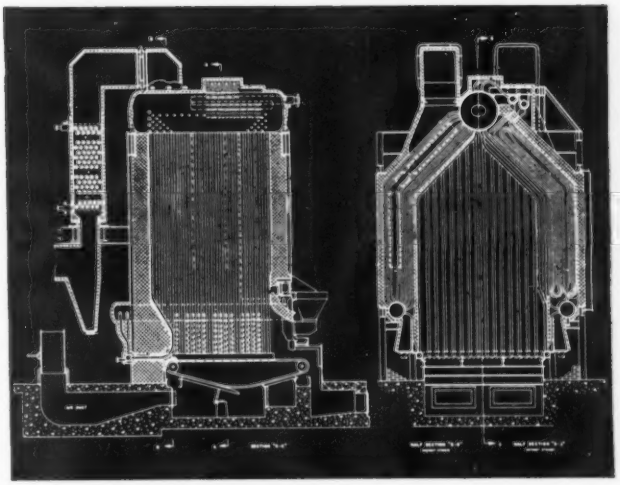
EASTERN MANUFACTURER

Number of Units.....2
Steam Capacity.....32,000 lb. per hr.
Design Pressure .....300 lb. per sq. in.
Operating Pressure.....250 lb. per sq. in.
Final Steam Temperature.....471 deg. F.
Feedwater Temperature .....220 deg. F.
Fuel.....Pulverized Coal
Efficiency (with economizer).....84.4 per cent

This unit includes a controlled primary air heater to supply the pulverizers with preheated air.

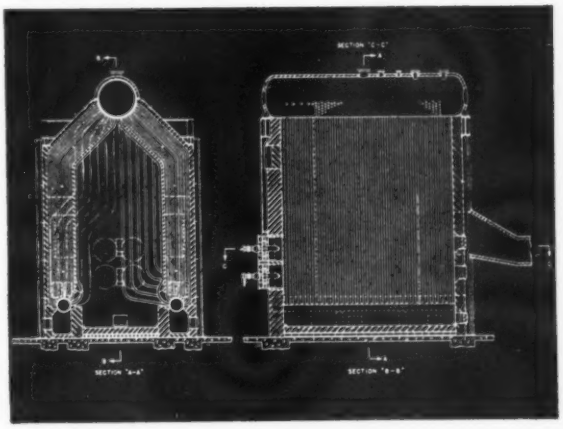


FOSTER



UNIT POWER PLANTS

Number of Units.....34
Steam Capacity.....38,000 lb. per hr.
Design Pressure .....475 lb. per sq. in.
Operating Pressure.....425 lb. per sq. in.
Final Steam Temperature.....740 deg. F.
Feedwater Temperature.....212 deg. F.
Fuel .....Bituminous Coal
Efficiency (with economizer).....80.6 per cent

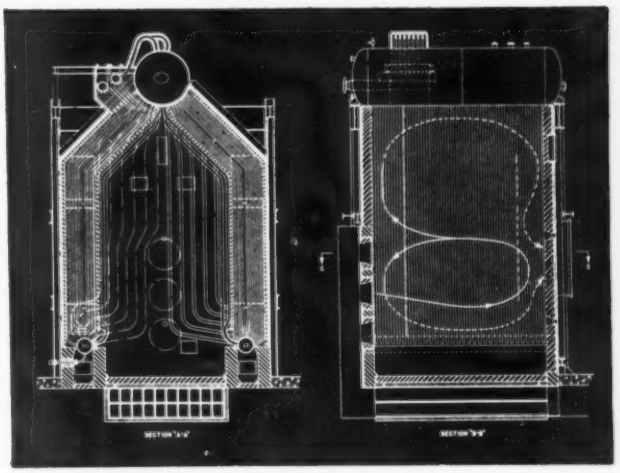


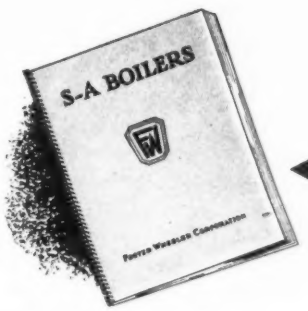
SOUTHWEST REFINERY

Number of Units.....5
Steam Capacity .....70,000 lb. per hr.
Design Pressure .....645 lb. per sq. in.
Pressure: Superheater Outlet.....250 lb. per sq. in.
Final Steam Temperature.....(Saturated)
Feedwater Temperature.....225 deg. F.
Fuel.....Refinery Gas
Efficiency.....79.1 per cent

FAR WEST REFINERY

Number of Units 2
Steam Capacity.....125,000 lb. per hr.
Design Pressure.....500 lb. per sq. in.
Pressure: Superheater Outlet...450 lb. per sq. in.
Final Steam Temperature.....560 deg. F.
Feedwater Temperature .....220 deg. F.
Fuel.....Oil and Gas
Efficiency (oil fired with air heater)..85.0 per cent





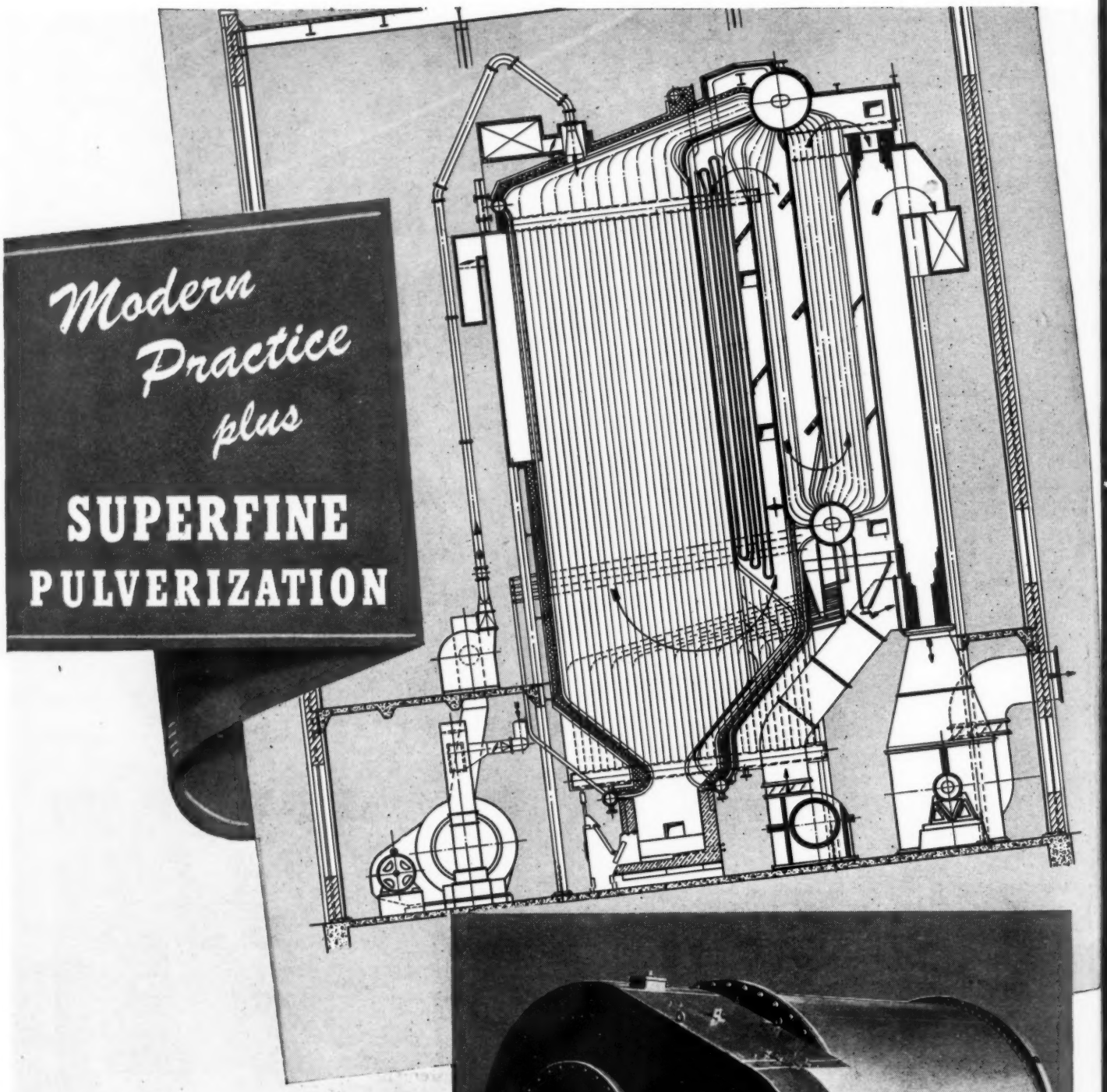
The detailed story of the S-A boiler—

◀ *ASK FOR BULLETIN B-44-5*

FOSTER WHEELER CORPORATION

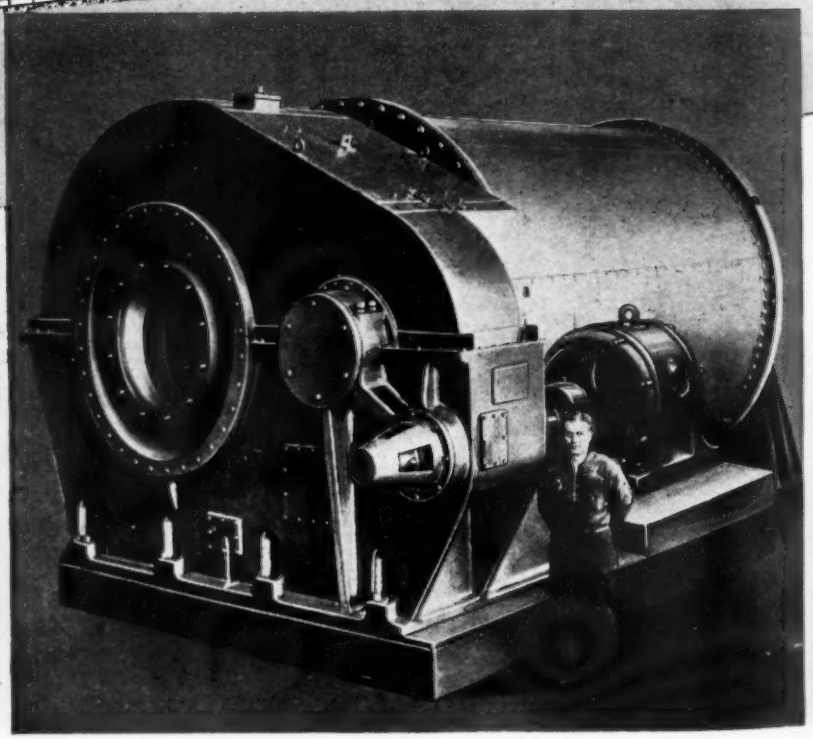
165 Broadway, New York 6, N. Y.

WHEELER



Modern Practice plus

SUPERFINE PULVERIZATION



THE Kennedy Air-Swept Tube Mill will pulverize all grade coals at low cost for power and maintenance. It is unaffected by tramp iron, or coals of low grindability. Because of the rapid drying effect achieved, the KVS Pulverizer will handle coal having a high moisture content. Continuous fine grinding with 85 to 95% through 200 mesh and 70% through 300 mesh is demonstrated in actual practice.

KVS PROVIDES ALL ESSENTIALS
in DESIGN *and* EQUIPMENT
for Efficiency and Low Cost Operation

Convection type steam generating units of the type shown here are designed and built by KVS for operation on the full range of coals including anthracite or coke breeze as well as gas or oil. They are designed and built for capacities, pressures and steam temperatures to meet individual specifications.

TOP FIRING AND BOTTOM OUTLET

This design provides better combustion control because it is not necessary to "fight" the coal being burned. Even distribution of radiant heat is attained over furnace area. Through the use of the KVS Pulverizer which assures proper coal preparation, and with bottom outlet, carbon loss is controlled.

STEAM PURIFIER

A highly efficient means of purifying steam is provided by the KVS Steam Purifier. Less than one-half of one part per million of impurities is carried over.

CONVECTION SUPERHEATER

The KVS Superheater in this steam generator unit is damper controlled and so designed as to attain uniform final steam temperatures over entire operating range.

AIR PREHEATER

This component is of compact design and is included in the boiler structure itself.

SHADOW WALLS

Increased heat absorbing surface is provided by KVS Water Walls, assuring a clean furnace and avoiding refractory maintenance.

TANGENT TUBE REAR FURNACE WALL

This design reduces refractory to absolute minimum and affords greater black surface area, minimizing soot or slag accumulation.

DRY BOTTOM FURNACE

Concentration of heat is eliminated in this feature of KVS design and tube failures thereby minimized.

PERFECT PULVERIZATION

The KVS Integral Drive Air-Swept Tube Mill provides perfect pulverization controlled by air separation. This unit assures proper preparation and carburization of all grades of coal at low power and maintenance costs.

KVS Engineering

KVS steam generating equipment has been performance-proved over the years. KVS offers a complete service in design, building and erecting complete plants under one responsibility. KVS engineers are available for consultation on your requirements.

Send for KVS Bulletin No. 44B containing valuable information on steam generation and coal pulverization.

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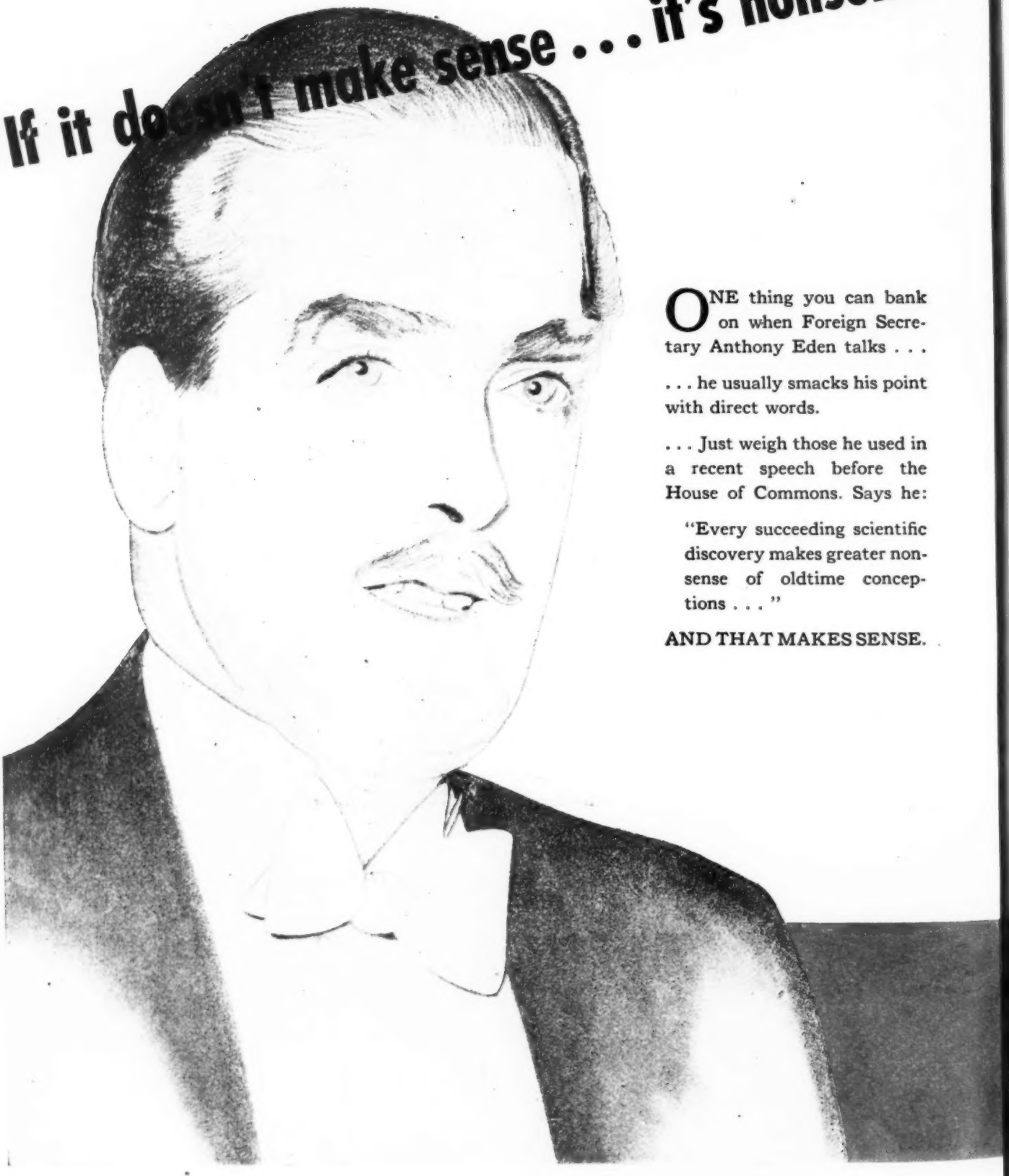
then he said to himself

If it doesn't make sense . . . it's nonsense



ONE thing you can bank on when Foreign Secretary Anthony Eden talks . . .

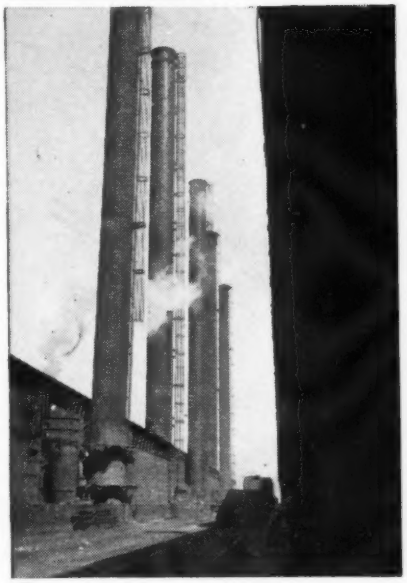
. . . he usually smacks his point with direct words.

. . . Just weigh those he used in a recent speech before the House of Commons. Says he:

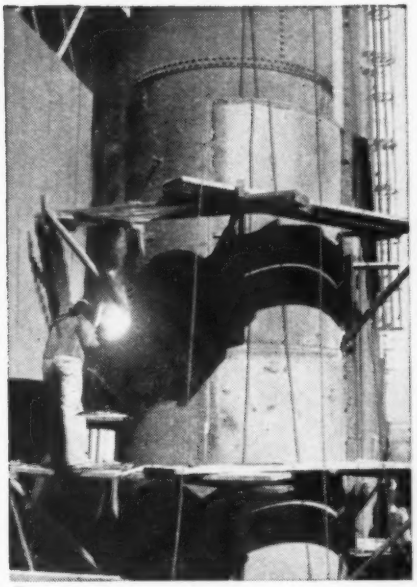
"Every succeeding scientific discovery makes greater nonsense of oldtime conceptions . . . "

AND THAT MAKES SENSE.

LOOK, A. E., how arc welding makes sense in the replacement of rusted-out riveted smokestacks:



A



B

C

How to replace a smokestack at ½ usual cost

Job. Replace 14 steel mill smokestacks... 155′ high; 6′-8″ diam . . . corroded, with many rivet heads out entirely. Do so without interrupting furnace operation.

How. Build a new welded smokestack around old stack. (A) shows four completed, (B) one under construction. Join new bottom plates to old tapered base as shown in (C) . . . reinforcing with eight 5-inch channels welded in place. Roll plate half-round for 7′-4″ diameter. Use butt circumferential and longitudinal joints and weld with 5/32″ "Fleetweld 5" Electrode. Cut out old stack and remove piece at a time from inside base.

Result for job shown. New stack, 8″ larger, has greater capacity. Not one hour of furnace operation was lost. *Cost was less than half that estimated for riveted construction* . . . AND THAT MAKES SENSE.

Link-up with Lincolneering for help in solving construction and maintenance problems with arc welding. No obligation.

THE LINCOLN ELECTRIC COMPANY • DEPT. 431 • CLEVELAND 1, OHIO

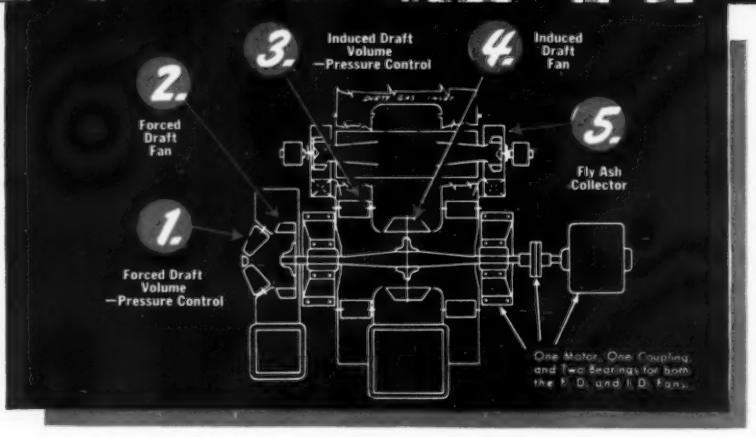
America's greatest natural **recourse**

ARC WELDING

one COMPACT unit

..THAT PERFORMS ALL 5 MECHANICAL DRAFT FUNCTIONS

There's no need to "assemble" your mechanical draft system piece-meal, from a number of separate units—Sturtevant wraps them all up in this compact, 5-in-1 package that actually takes up less space than many units which do not include all of these mechanical draft functions! In the S. A. I. D. Duplex arrangement, you get forced and induced draft, plus volume and pressure control for both fans, plus a fly-ash disposal unit that's built right into the system. Now giving distinguished service in many leading power plants, this Duplex arrangement is typical of the kind of engineering which has made Sturtevant the No. 1 source of mechanical draft equipment throughout the country. Write for complete details.


1. Forced Draft Volume —Pressure Control
2. Forced Draft Fan
3. Induced Draft Volume —Pressure Control
4. Induced Draft Fan
5. Fly Ash Collector
One Motor, One Coupling and Two Bearings for both the F. D. and I. D. Fans.

HEATING • VENTILATING • AIR CONDITIONING •

DRYING • DUST AND FUME CONTROL

NOW...FOR THE FIRST TIME...YOU CAN DEAL WITH

one source

FOR ALL YOUR AIR-HANDLING EQUIPMENT

As a Division of Westinghouse Electric, Sturtevant now offers the most complete line of air handling equipment ever available from a single manufacturer!

Sturtevant has always been known as industry's leading source for mechanical draft systems. And now, backed by the resources of Westinghouse Electric, Sturtevant is the *only* manufacturing source that offers these three important advantages:

1. **UNDIVIDED RESPONSIBILITY** for the *complete* mechanical draft system, from planning to final assembly, installation and service.

2. **IMPARTIAL ENGINEERING HELP** because Sturtevant engineers aren't "pushing" one particular type of equipment. Between them, Sturtevant and Westinghouse manufacture every part of the complete system—motors, controls, fans, fly-ash disposal units and the new Precipitron*. Thus Sturtevant engineers can always recommend exactly the right equipment for any particular installation.

3. **COST SAVINGS** that come from buying the system is one complete package. No extras, no "special" charges. And without skimping on quality, Sturtevant has effected many new production economies that mean still further savings on the initial cost.

If the replacement of war-weary equipment is a problem in your plant, Sturtevant engineers will be glad to study your needs. For further information, write: B. F. Sturtevant Company, Division of Westinghouse Electric, Hyde Park, Boston 36, Mass.

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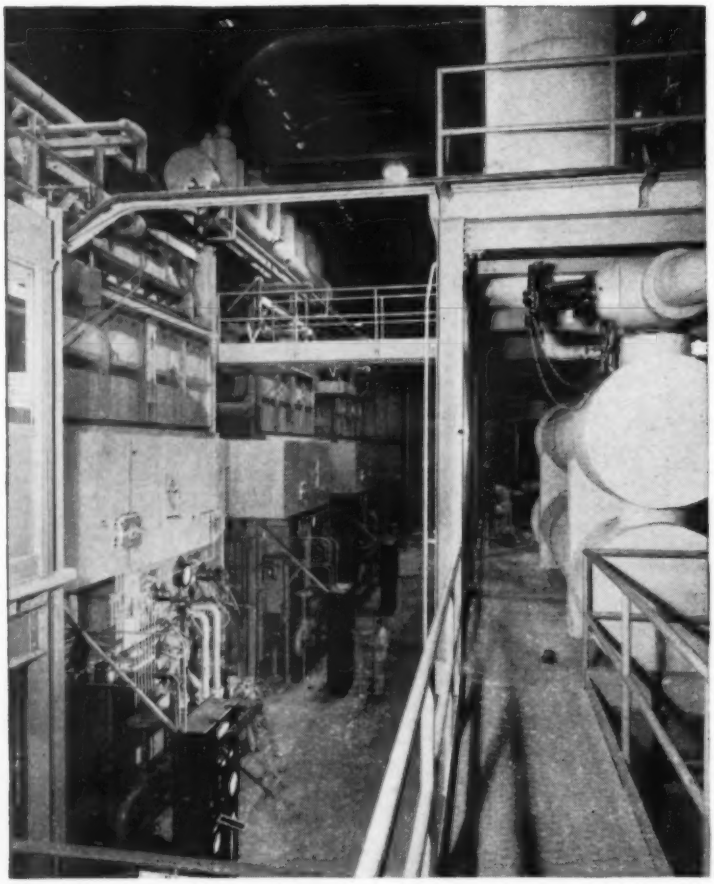
Sturtevant
REG. U.S. PAT. OFF.
Puts Air to Work

B. F. STURTEVANT COMPANY • DIVISION OF
Westinghouse
ELECTRIC

PRECIPITRON
MECHANICAL DRAFT

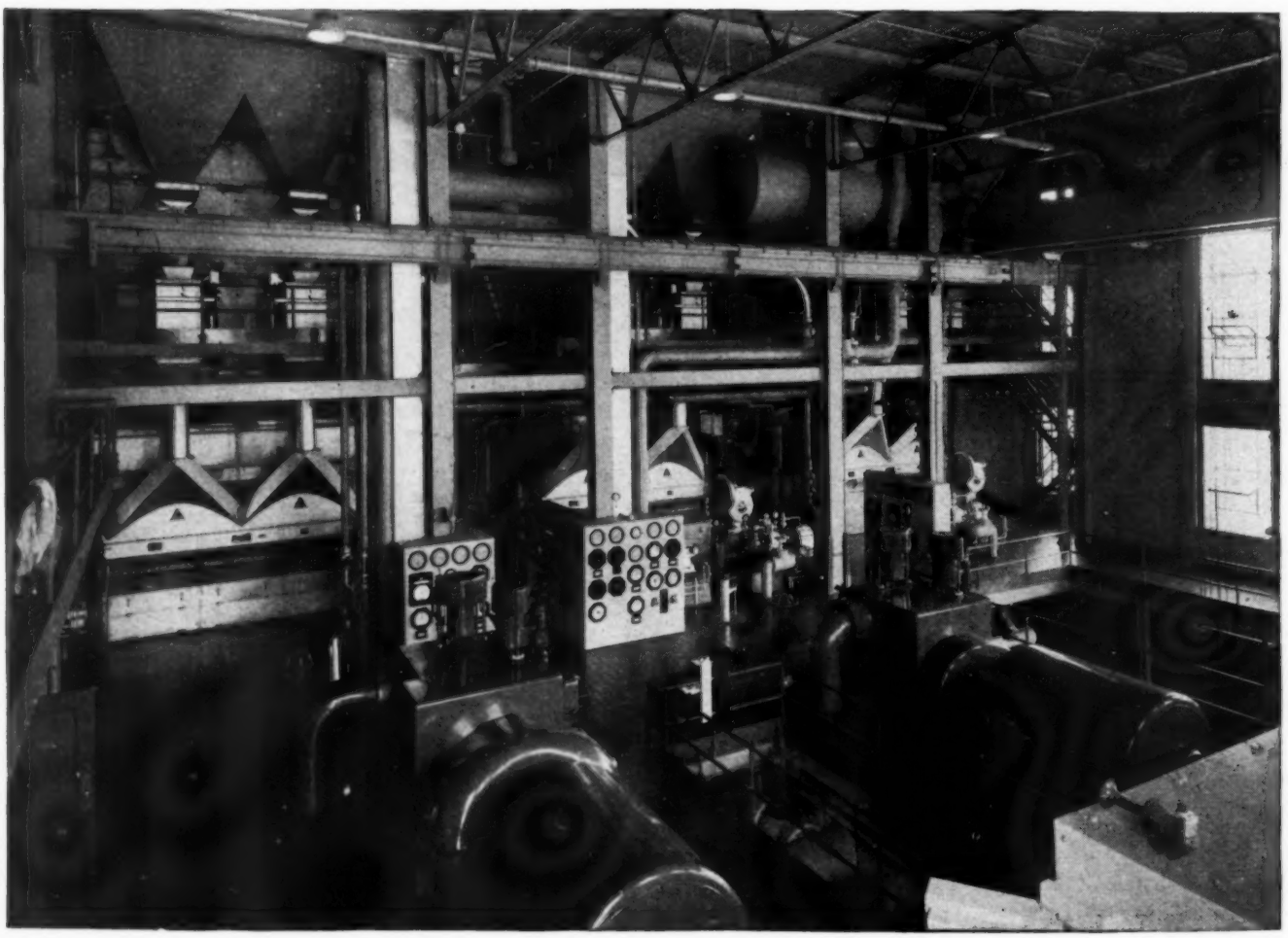


IT TAKES

Left:
Interior view of a new 400,000 lb. steam generating plant suppling steam for a modern industrial plant. Steam is generated in three gas fired boilers which are operated by a Republic automatic combustion control system.

●

Below:
A Republic combustion control system operates the three boilers in this new power plant which supplies all the steam and power for a large university. During the first year of operation this new plant provided heat for 13.0 percent more building space, generated 114.3 percent more electric power but consumed 9.86 percent less fuel.



MORE THAN A GOOD BOILER TO CUT STEAM COSTS!

Low Steam Cost Is Not The Result Of Efficient Boiler Design Alone! It Is Determined By The Degree With Which Your Method Of Boiler Control Takes Full Advantage Of Those Economies Which Have Been "Built In" The Boiler And Its Auxiliaries.

To realize all the financial and operating advantages of modern boilers, they must be closely controlled. They have comparatively small water storage spaces and high combustion rates, hence under some conditions may be very sensitive to load fluctuations. In operating them, therefore, a number of repetitive adjustments must be made frequently and practically simultaneously on several units of auxiliary equipment in order to maintain highest boiler efficiency. The difficulty of making the required repetitive adjustments accurately and synchronously by hand at the individual auxiliaries is obvious.

What is needed, therefore, is a method for making and co-ordinating these adjustments automatically from a centralized control point, at the same time permitting the operator to assume manual control at this point whenever necessary or desirable.

The REPUBLIC combustion control is a unified system controlling simultaneously, in measured quantities and in fixed (adjustable) proportions, the fuel and air input to the boiler. It increases or decreases the fuel and air supply to the boiler in the correct amount to maintain constant steam pressure and in the correct ratio to maintain maximum combustion efficiency.

REPUBLIC combustion control systems are designed and built for all sizes of boilers—all types of fuel firing equipment—all load conditions. They fulfill all the conditions of theoretically perfect combustion control and still meet all the demands of every-day operating requirements.

This 94 page data book on automatic combustion control is filled with usable information generally difficult to locate. If you are interested in the advantages of automatic combustion control, write for Data Book No. S-21.

REPUBLIC FLOW METERS CO.

2222 DIVERSEY PKWY. CHICAGO 47, ILL.

"There's an YARWAY

1 Floatless

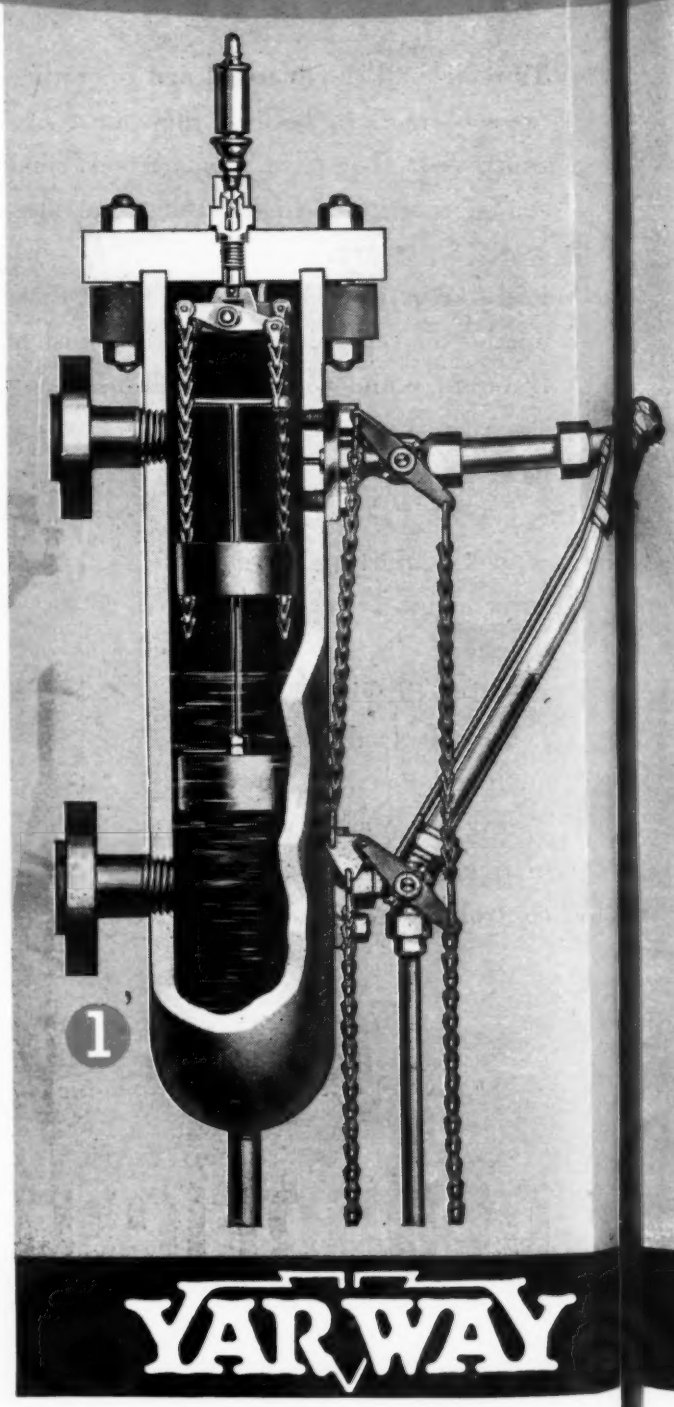
Yarway's Hi-Lo Alarm Water Column has an alarm mechanism that is simple . . . dependable . . . unique. Solid weights operate the whistle alarm. The principle employed is that heavy objects submerged or partly submerged in water are buoyed up by a force equal to the weight of the water they displace. Any dangerous change in water level causes the weights to open or close a needle valve through which steam is admitted to the alarm whistle. The alarm is always dependable . . . the weights can never become waterlogged. Yarway Column shown has Sesure Inclined Gage for pressures up to 400 psi. Flat Glass Gages furnished for pressures to 1500 psi. Ask for Bulletin WG-1810.

2 Remote

Yarway's Remote Water Level Indicator brings overhead boiler water level readings right down to eye level, on the instrument panel or other convenient place, on a brilliantly lighted red and green scale. Indication is *positive* and *instant* because the instrument is operated by the boiler water itself. Shows boiler water level beyond the range of overhead gage, and always indicates high or low—even when full or empty overhead gages look the same. Suitable for all pressures to 1500 psi. Ask for Bulletin WG-1820.

3 Seatless

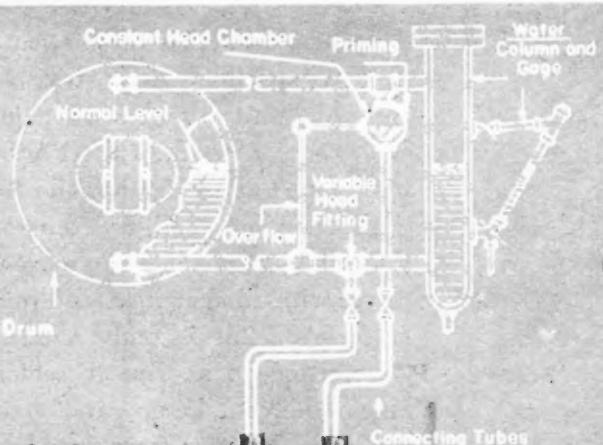
Yarway's famous Seatless Blow-Off Valve eliminates one of the commonest sources of trouble and expense in boiler blowdown service. *There is no seat* to score, wear and clog with mud, dirt and scale. Balanced sliding nitralloy plunger and straight through flow make operation easy. Today this valve is "standard" in over 12,000 boiler plants. Suitable for all pressures up to 2500 psi. Ask for Bulletin B-424 (to 400 psi), Bulletin B-432 for higher pressures.



YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.

Engineering Reason"

BOILER TRIM



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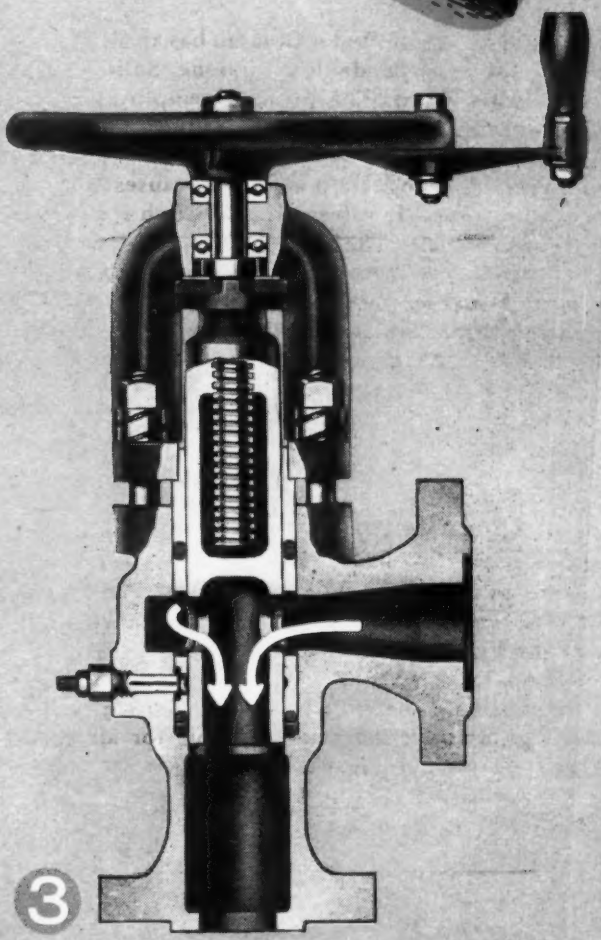


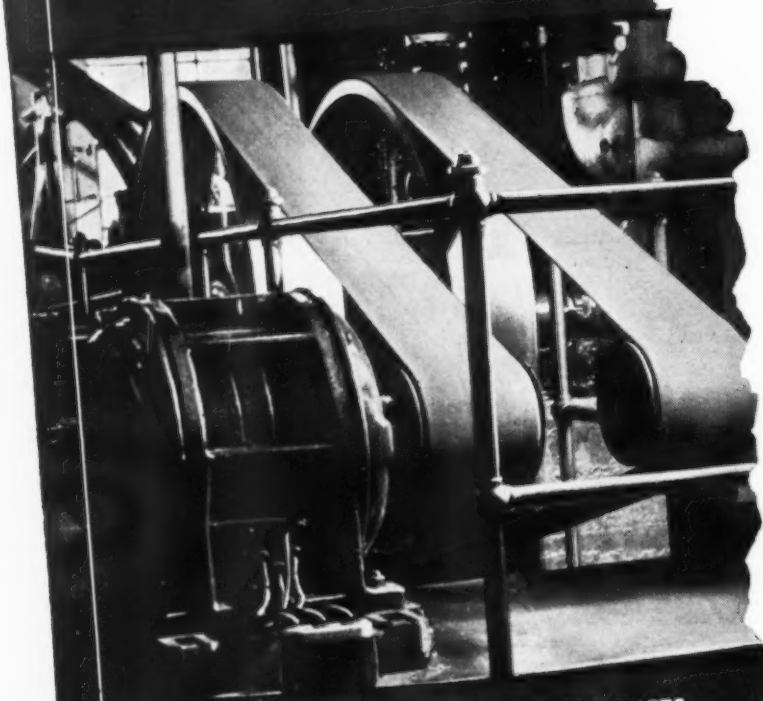
3

See Yarway Boiler Trim "in action" in the 30-minute color motion picture, "There Is An Engineering Reason." Hear Lowell Thomas describe their principles and operation. Now available without charge for group showings. Write today.

STEAM PLANT EQUIPMENT

Tames "KILLER" DRIVES

—because it's sinewed with steel



GOODYEAR INDUSTRIAL RUBBER PRODUCTS

GM-Specified COMPASS 250 STEEL CABLE TRANSMISSION BELT for Heavy-Duty Drives

The Goodyear COMPASS 250 Steel Cable Transmission Belt is bodied with multi-strand airplane-type cable, spiraled continuously without a splice. Cable on opposing sides of belt axis is twisted in opposite directions to insure true running.

IF you've got a drive that's a killer —a drive that quickly wears out even extra-tough belts—you can tame it with Goodyear's COMPASS 250 Steel Cable Belts. They have power-load capacity up to 37 horsepower *per inch of width!* TWICE the horsepower rating, width for width, of the best belts heretofore available!

That's because they're sinewed with endless, multiple-strand steel cables, embedded in the very highest quality rubber. As a result, COMPASS 250 belts can handle far heavier loads, withstand much higher tensions—thus making possible more compact drives with smaller belts and pulleys. COMPASS 250 is truly *stretchless*. Once fitted to a drive it seldom if ever requires take-up, and creep is negligible. It is far more flexible than any plied-up fabric-bonded belt and has far longer life expectancy.

You'll want all of the details on COMPASS 250 belts—facts and figures on the way they can increase operating efficiency while they lower maintenance costs. To get them, phone the G.T.M.—Goodyear Technical Man—or your nearest distributor of Goodyear Industrial Rubber Products.

• • •

FOR HOSE, BELTING, PACKING, MOLDED RUBBER GOODS built to the world's highest quality standard, phone your nearest Goodyear Industrial Rubber Products Distributor.

Compass—T.M. The Goodyear Tire & Rubber Company

GOODYEAR

THE GREATEST NAME IN RUBBER

"THE HANDIEST TESTING INSTRUMENT WE'VE EVER HAD"

say hundreds of users

MEASURES BOTH

VOLTS AND AMPERES

(ACCURACY 3%)

G-E HOOK-ON VOLT-AMMETER

You get double value from this handy, portable, a-c instrument. It will measure up to 600 volts and up to 600 amps. Just hook it around the conductor, push to close the gap, and read the current. Leads are provided for voltage measurements. Booklet GEA-2950 gives complete details, prices, and many helpful suggestions for operating this versatile instrument. Ask your G-E representative or write General Electric Company, Schenectady 5, New York.

HEADQUARTERS FOR MEASUREMENT

GENERAL ELECTRIC

602-94-6200

THIS COMBINATION OF THE *Right* BOILER AND THE *Right* STOKER

When we say hundreds of plants we mean it literally for there's no combination of equipment in the whole C-E line, from 30 hp HRT boilers to million-lb per hr units, that is so well adapted to a wide range of conditions and requirements.

The C-E Spreader Stoker will burn satisfactorily a wider range of coals than any other stoker; for example, the high ash, high volatile coals of the Pacific Coast region, the sub-bituminous coals and lignite of the West, the free-burning clinkering midwestern coals of Illinois, Indiana, Ohio and Western Kentucky and the caking bituminous coals of the East. Poor quality, fine sizing and other undesirable characteristics are all taken in stride by the C-E Spreader—the nearest thing there is to a universal stoker. With a furnace design properly adapted to the requirements of spreader firing, as it is in Combustion's VU Unit, advantage can be taken of whatever low-priced coals the market affords.

The VU Unit as a whole was initially designed to bring central station performance standards to the average plant. That it met this objective is now a matter of record in hundreds of installations. The quality of its design and construction is perhaps best evidenced by its ability to stay on the line for long periods of uninterrupted service. Translated into economic terms, this means maximum protection against direct and indirect outage losses which in many plants can easily be of substantial proportions. It also means low year-in and year-out maintenance. Coupled with the high efficiency characteristic of VU performance, these advantages add up to low overall steam costs, or, to put it another way, high return on investment.

Installations of this VU—Spreader Stoker combination now have an aggregate capacity of more than 2,500,000 lb of steam per hr. Units ranging in capacity from 20,000 to 100,000 lb per hr are in use in a wide variety of processing and manufacturing industries not only throughout the United States but in South America and in such remote regions as Russia and China. Their performance records are your assurance of efficient, dependable operation.

So, unless your steam plant is all that it should be — modern, efficient, reliable and able to cope with almost any fuel situation — plan now for its rehabilitation. As a first step, why not investigate the C-E Spreader fired VU Unit?

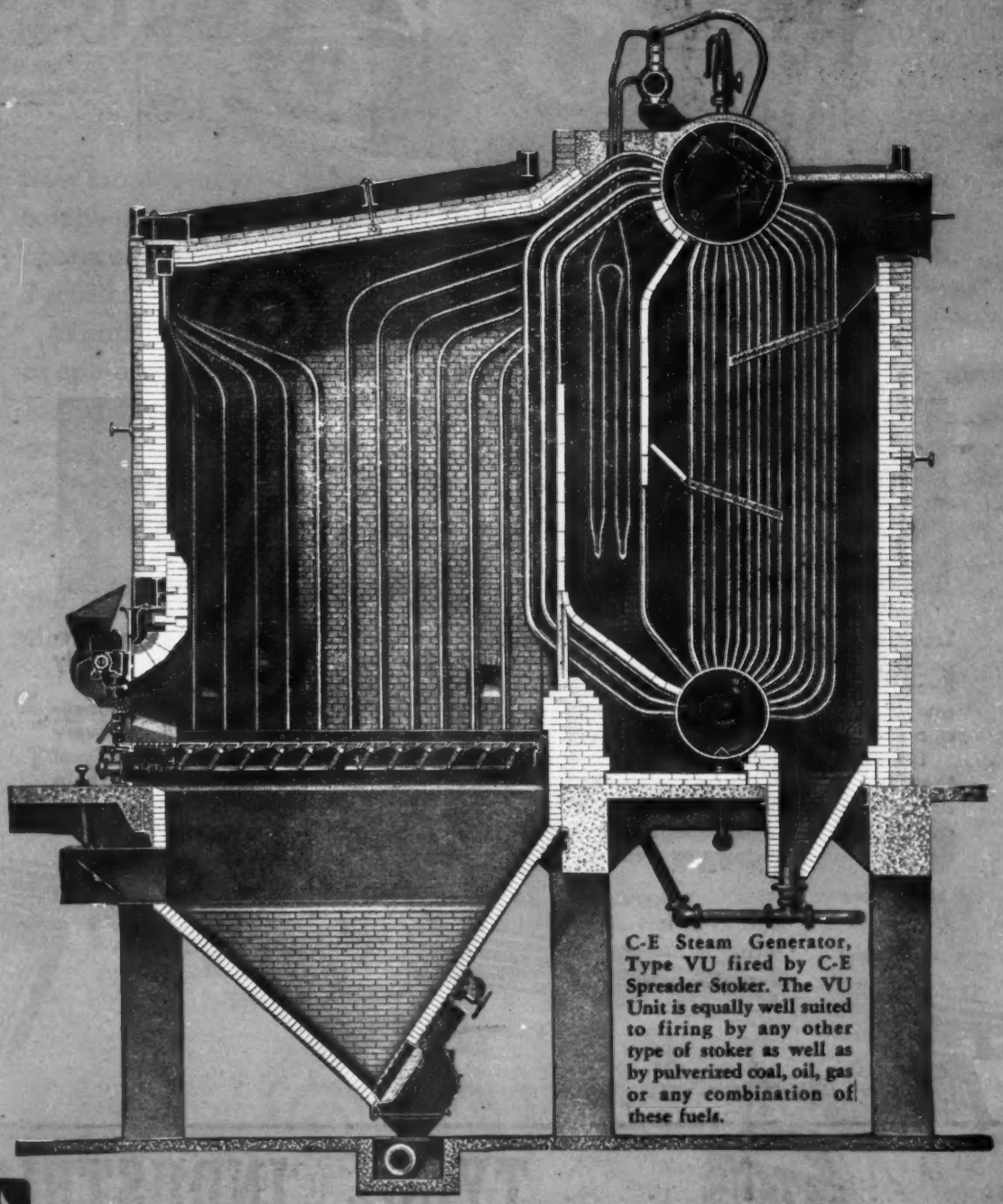
A-936

COMBUSTION ENGINEERING

200 MADISON AVENUE • NEW YORK 16, N. Y.

IS PROVIDING THE *Right* ANSWER

. . . IN HUNDREDS OF PLANTS

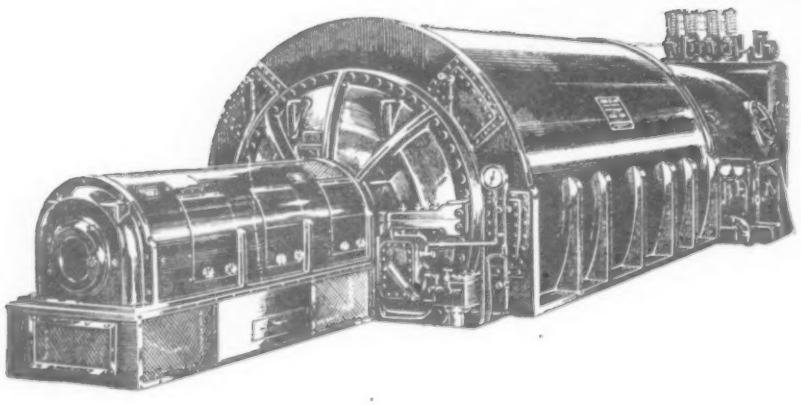


C-E Steam Generator, Type VU fired by C-E Spreader Stoker. The VU Unit is equally well suited to firing by any other type of stoker as well as by pulverized coal, oil, gas or any combination of these fuels.

C-E

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

Today's Production Whirlwind *calls*



New TYCOL RIO TURBINE OILS...

Positive Protection for Your Turbines

Trouble-free, long-life turbine operation depends on the selection of a lubricant of known purity . . . service endurance . . . and high rust and oxidation inhibiting qualities.

Tycol's new RIO Turbine Oils provide that kind of lubrication. Repeated tests, in actual turbine units, showed original viscosity and acidity unchanged. Also, no time-wasting shut-down to clean out the oil reservoir was necessary. A little make-up oil and water removal was practically the only lubrication service demanded.

There are many other time- and money-saving advantages available to every turbine operator through these new Tycol RIO oils . . . one or more are certain to help you. Call in a Tide Water Associated engineer today. Ask him to explain the full benefits of Tycol RIO oils.

INDUSTRIAL TYCOL OILS-GREASES

TYCOL INDUSTRIAL

ENGINEERED FOR EVERY

for TYCOL
ENGINEERED LUBRICATION

Now more than ever before it is essential to use the best lubricants that can be obtained — for maximum production . . . top efficiency . . . lowest operating cost. That's why more and more operators are turning to Tycol scientifically engineered oils and greases.

Whatever your lubricating need — for mine car or tipple, textile loom or spindle, stationary Diesel or locomotive, steam engine or turbine . . . for extreme pressure, high or low temperature, heavy duty, high speed, or any other service condition — there's a Tycol oil or grease exactly suited to your specific need.

In developing this comprehensive line, Tycol subjects each individual oil and grease to rigid tests during manufacture. This control assures the required lubrication characteristics for maximum performance of that particular product.

Let us prove Tycol Engineered Lubrication efficiency to you . . . show you the extra value in every measure of Tycol oil and grease. Write your nearest Tide Water Associated office for the facts.

***SPECIFIC GRAVITY.** Clear, concise descriptions of the basic tests used to determine important lubrication properties — Carbon Residue, Pour Points, Specific Gravity and others — are given in Tide Water Associated "Lubricania". For your FREE copy write: Tide Water Associated Oil Company, 17 Battery Place, New York 4, N. Y.

LUBRICANTS
SERVICE NEED

TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE · NEW YORK 4, N. Y.

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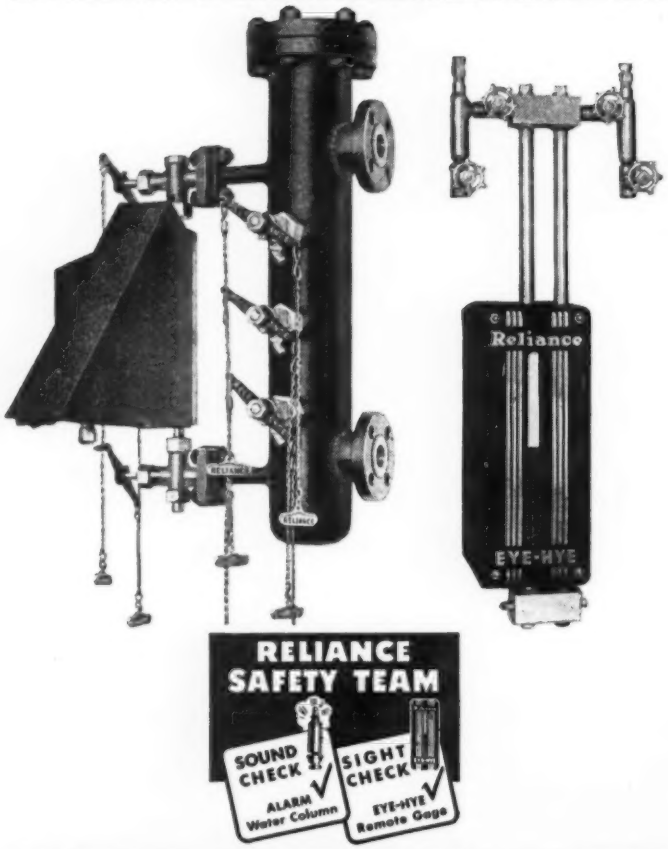
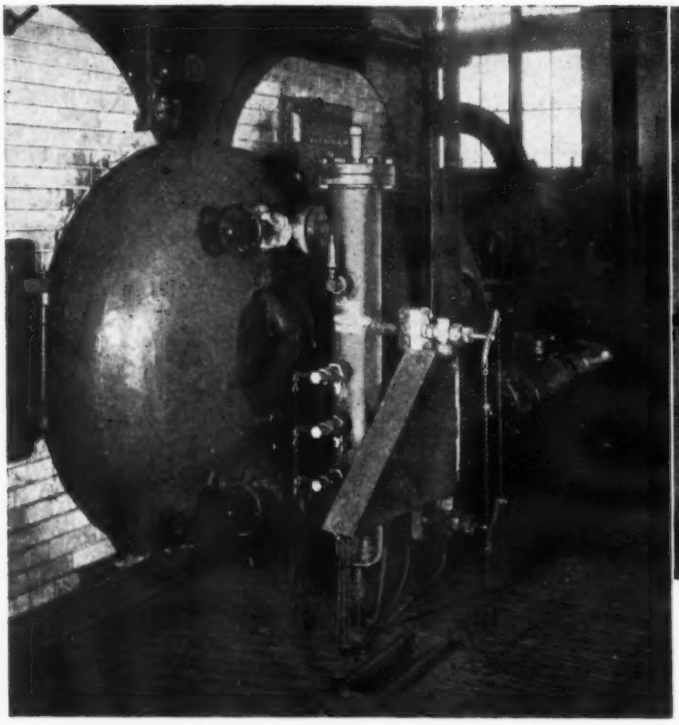
Reliance

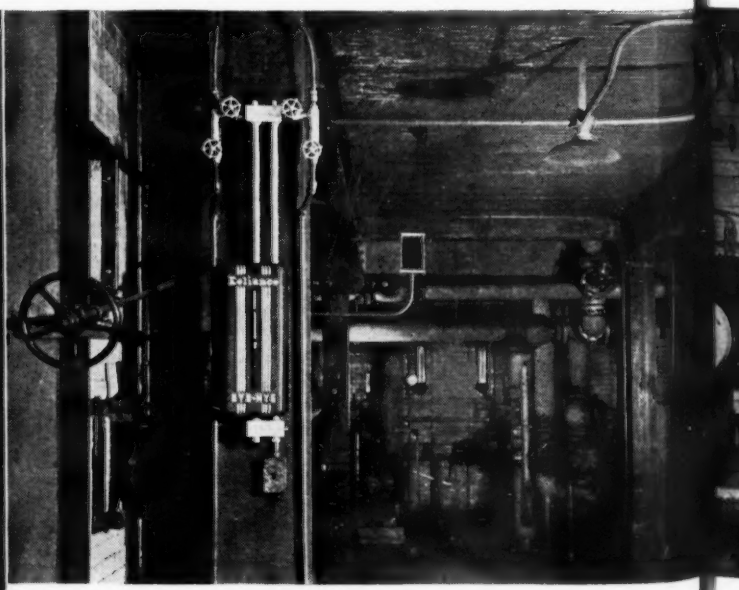


help you avoid dangerous low or high water levels

One way to safeguard your production and earnings is by making sure you have accident-preventing water level supervision. Reliance ALARM Water Columns and EYE-HYE Remote Reading Liquid Level Indicators form the *safety team* that protects thousands of vital boilers, such as the installation pictured here. And you can help yourself to better water level supervision *all the way* by using Reliance Equipment on heater tanks, surge tanks and other liquid storage vessels.

Known the world over for accuracy, sturdiness and





Left: Reliance Forged Steel Water Column with Prismatic Periscope on drum three floors above firing floor.

Above: One of five Reliance EYE-HYE Remote Reading Liquid Level Indicators mounted on pillars beside each boiler.

BOILER SAFETY DEVICES

help you conserve fuel by more efficient operation

dependability, there's a Reliance Water Column for every type of boiler—*any pressure*—and gage equipment, including several special EYE-HYE models, to suit every water level checking need. Reliance Equipment brings you the advantages of trouble-free, low-maintenance service. Write for complete information or ask your consulting engineer.

The Reliance Gauge Column Company
5902 Carnegie Avenue • Cleveland 3, Ohio

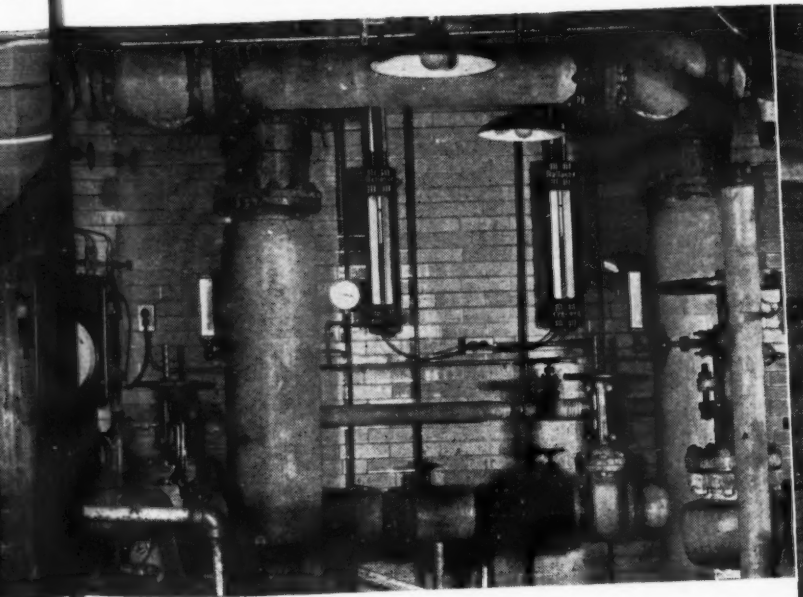
Modern Water Level Supervision *All the Way* in this Water Works Plant

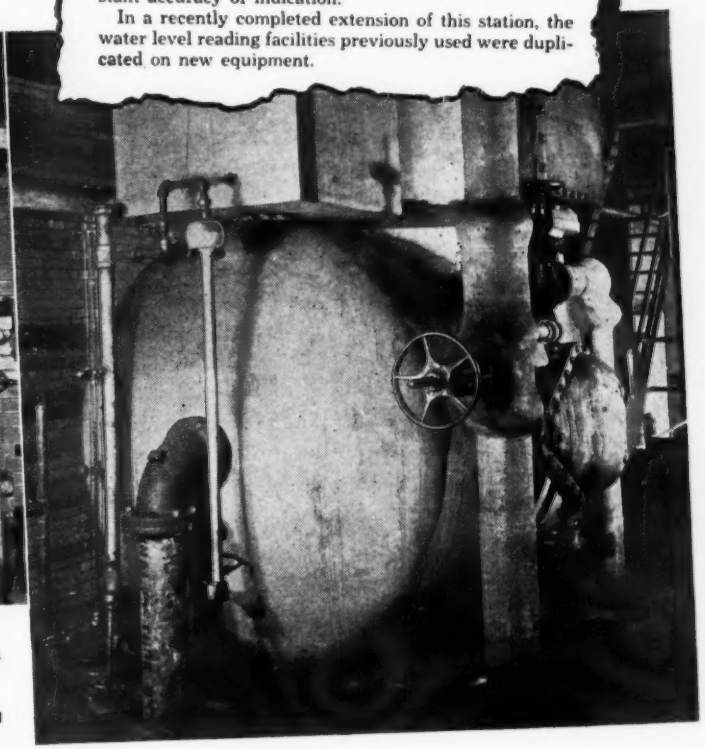
AN EXCELLENT example of consistency in equipment use is found in the Central Park Avenue Pumping Station of the Chicago Water Works. A high standard of water gage visibility has been established which is carried out at all important points of water level reading.

The basic drum-mounted gage on each boiler is part of the Reliance Water Column equipment. A mica-protected flat glass gage insert is arranged with efficient illumination permitting the water level image to be reflected by means of a periscope hood to a fixed mirror mounted below an aperture in the gallery floor. Duplicate reading facility for each boiler is supplied for extra safety. This is done by means of EYE-HYE indicators—hydrostatically operated U-tube manometers—which are conveniently located on columns near the front of each boiler unit. While the present operating pressure is 200 psi all the water gage equipment will be suitable without change for pressures up to 400 psi at such time as the boilers are uprated to this point. This is a factor frequently anticipated when equipment is designed or selected.

The importance of visualizing the amount of heated feed water supply is taken into account also. One of the photographs below shows two wall-mounted remote reading indicators which reveal the levels in heater tanks some distance away; the other shows one of the heaters with a Unitemp mounted at one end of the tank. This is an actuating element which equalizes temperatures of the liquid in the manometer legs, assuring constant accuracy of indication.

In a recently completed extension of this station, the water level reading facilities previously used were duplicated on new equipment.





Above: Close-up of two EYE-HYE Indicators for Feedwater Heaters. Faces can be scaled, when desired, to show gallons, etc.

Right: One of two Feedwater Heaters, showing the Unitemp condensing reservoir temperature equalizing device for the EYE-HYE.

What a Whale of a Difference!

. . . BUT THE BASIC PRINCIPLE IS STILL THE SAME

IMPROVEMENTS Make the Difference in Æ Taylor Stokers, Too!

THE NEW Taylor Stoker shatters underfeed stoker tradition. All former designs of "continuous ash discharge" stokers were really intermittent and not continuous. Not content with this arrangement, Æ engineers perfected and now offer two outstanding advancements–

Positive movement of refuse all the way to the tip of the ash discharge plates, assuring continuous fuel bed movement and uniform combustion throughout the fuel bed,

And . . .

Ash discharge opening automatically adjusted to the size of clinkers. Counterweighted ash discharge plates open to allow large clinkers to pass, and then return to normal sealing position.

Check these two outstanding advantages of Æ Taylor Stoker Ash Disposal yourself. See Catalog R-A for all the benefits of Æ Taylor Stokers. Your copy is waiting.

Other Æ Products: Æ-Perfect Spread Stoker, Lo-Hed Hoists, Marine Deck Auxiliaries, Hele-Shaw Fluid Power.

Æ

TAYLOR STOKER

AIR-COOLED & WATER-COOLED

The Only Underfeed Stoker with *all* these Features IN COMBINATION!

1. Continuous Self-Sealing Ash Disposal
2. Movable Ash Discharge Plates
3. Smooth-Flow Hydraulic Drive on Rear End
4. Independent Pusher Controls within ⅛ inch
5. Unique Sure-Feed Coal Agitators
6. Silent-Shift Spur Gear Planetary Power Transmission

AMERICAN ENGINEERING COMPANY

PHILADELPHIA 25, PENNSYLVANIA

NO "GLAND TROUBLE"

Because UNITROL level Controller has no packing glands or stuffing box

On recirculator systems of condenser hotwells, deaerators—or wherever the level of liquids must be controlled—UNITROL will do it more accurately! Simple . . . self-contained . . . this exclusive design eliminates trouble-making restrictive elements. Friction is minimized. Action is free and unhampered. Feed or drain is regulated promptly and positively. The float is linked to the inner valve through ratio connection, with maximum float travel on any size valve of only 7 inches. Available for temperatures up to 750° F.—in valve sizes ½" to 4"—integral casting construction—valve and float-cage of semi-steel or cast steel—float of seamless copper or stainless steel—and with the fine craftsmanship for which K & M has been recognized for 75 years. Our Engineering Department will be glad to make specific recommendations.

Write for Catalog 66-C

KIELEY & MUELLER, INC.
MANUFACTURERS OF PRESSURE AND LEVEL CONTROLS
2001 - 43RD ST., NORTH BERGEN, N. J.

Awarded our employees for outstanding production achievement

35.8% SAVING IN

With Iron Fireman Pneumatic Spreader

FOREST PRODUCTS TREATING COMPANY
PRODUCERS & PRESERVERS
OF
POSTS · POLES · PILING
LUMBER · TIMBERS
CROSS TIES
PORTLAND 5, OREGON

PLANTS
THE DALLES, OREGON
LARAMIE, WYOMING
WALDEN, COLORADO

GENERAL OFFICE
834 PITTOCK BLOCK
PORTLAND 5, OREGON

September 17, 1945

Iron Fireman Manufacturing Co.
4784 S. E. 17th Avenue
Portland, Oregon

Gentlemen:

In April, 1943, we installed two of your Iron Fireman Pneumatic Stokers under our two 186 HP., B&W Water Tube Boilers at our plant in The Dalles, Oregon.

During the 12-month period of hand firing immediately preceding the installation of the stokers, our total coal consumption was 10,709,350 pounds. In the following 12-month period we used only 7,093,220 pounds. When these figures are analyzed with plant output, we find that hand firing required 2.1572 lbs. of coal per cu. ft. of wood treated, while stoker firing required only 1.5205 lbs. - a very definite saving of 29½% in our coal bill.

After operating these stokers for some time, flue gas analyses indicated that we were still not getting full efficiency out of the stokers. Accordingly we installed draft gauges and recording CO_2 Analyzers as an aid in making adjustments on the coal feed, under grate air and damper controls. These adjustments are delicate enough so that we can fire with maximum efficiency and produce a chart recording CO_2 at from 14% to 15%, throughout the period between grate cleanings when load conditions are fairly uniform.

As was expected, our coal consumption during the following 12-month period dropped still further, to 1.4057 lbs. per cu. ft. of wood treated, making the surprising total of 35.8% saving in coal with the Iron Fireman Stokers as compared to hand firing under the same boilers.

Yours very truly,

FOREST PRODUCTS TREATING COMPANY

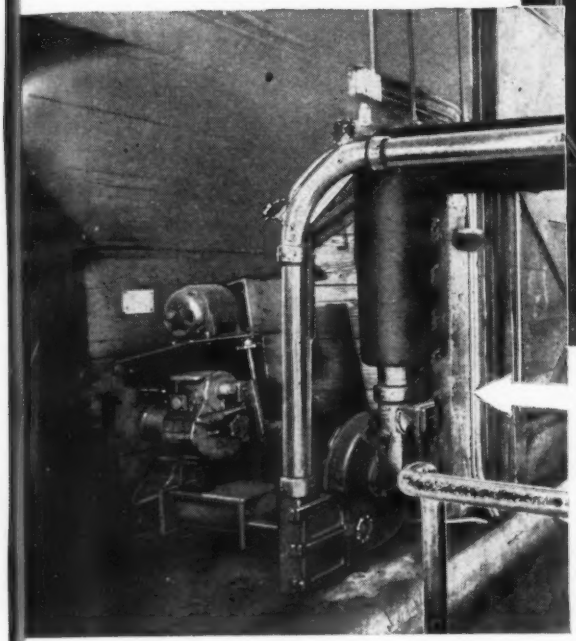
J. I. Hess

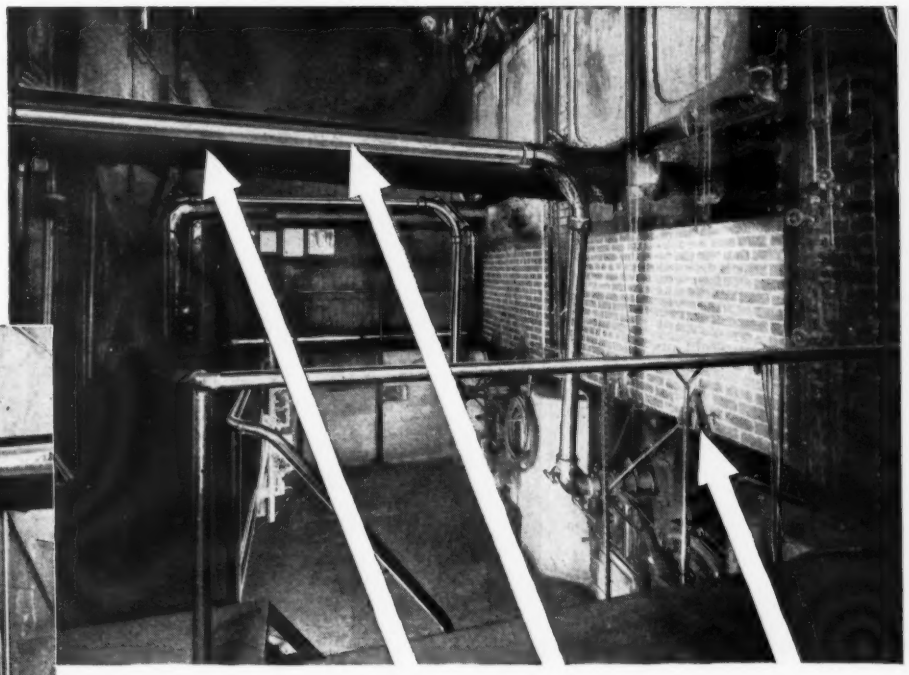
J. I. Hess, Chief Engineer

HEAVY DUTY AUTOMATIC COAL STOKER

IRON THE IRON FIREMAN

COAL
Stoker





COAL PICK-UP SECTION receives coal from bunker through short worm conveyor, where it is picked up by high velocity gases and delivered to furnace.

PRE-HEATED AIR CONVEYOR withdraws hot gases from combustion chamber. Adjustable air intake controls temperature of gases in pneumatic conveying system.

COAL CONVEYOR delivers coal from bunker to furnace, using a mixture of hot furnace gases and air as a conveying medium, preheating fuel en route.

CLEAR BOILER FRONT Stoker mechanism is not attached to the boiler front but is located near fuel supply, keeping mechanism cool and easily accessible.

Iron Fireman Pneumatic Spreader Stokers installed in Forest Products Treating Company plant at The Dalles, Oregon

Advanced Engineering. The extraordinary record of savings reported by Iron Fireman users is adequate evidence of sound engineering. Highly efficient combustion cuts fuel tonnage. Maintenance costs are remarkably low because no moving stoker parts are subject to high furnace temperatures and all mechanism is easily accessible. Many Iron Fireman stokers have been in continuous service for as long as 20 years.

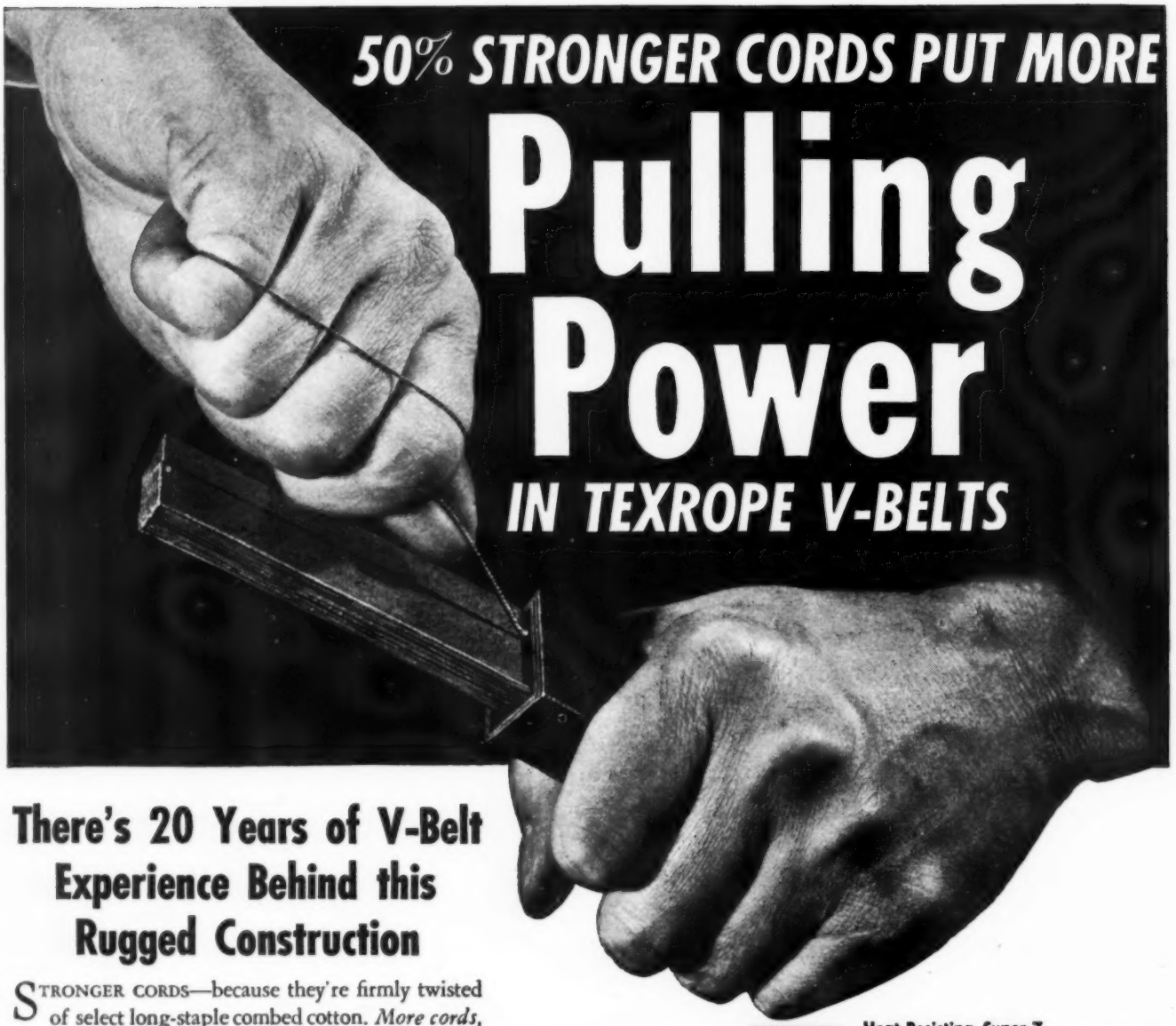
Adaptability. Because of its simple method of firing and fuel conveying, the Iron Fireman Pneumatic Spreader stoker has almost unlimited adaptability to existing boiler room layouts without costly remodeling.

Flexibility. This stoker has great flexibility of operation because it is highly responsive to widely fluctuating loads, and because it efficiently burns an extensive range of coals, including the small sizes, and low ash fusion coals as well as sub-bituminous and lignite.

Ask for Survey. Iron Fireman's nation-wide engineering, sales and service organization has had experience with every size and type of firing job. You can have a survey made of your boiler plant to determine what Iron Fireman stokers can accomplish for you. For such a survey or literature address: Iron Fireman Manufacturing Co., 3045 W. 106th St., Cleveland 11, Ohio. Other plants in Portland, Oregon; Toronto, Canada.

FIREMAN

FOR POWER PROCESSING AND HEATING



There's 20 Years of V-Belt Experience Behind this Rugged Construction

STRONGER CORDS—because they're firmly twisted of select long-staple combed cotton. *More cords,* too — accurately placed to carry heavier loads, and impregnated with gum rubber to absorb friction and heat.

Texrope "Super-7" V-Belts today are the finest in 20 years of continuous development by Allis-Chalmers—originator of the multiple V-Belt drive.

LONG WEARING — COOL RUNNING

Tough duplex cover to take the wear, keep the belt in shape. *Thick cushion* of war-proved Buna-S to protect the cord structure from shock. *Precision molding* to assure accurate section and a smooth running belt. For long service and highest efficiency on ALL V-Belt drives — make A-C your V-Belt headquarters! ALLIS-CHALMERS, Milwaukee 1, Wis.

WHICH OF THESE SUPER-7 V-BELTS DO YOU NEED

TEXROPE offers you the most complete line of V-Belts — types specially developed to meet ALL operating conditions. Pick the right TEXROPE Super-7 V-Belt — it'll give you the most in efficient power transmission.

Heat-Resisting Super-7
Stands temperatures up to 180°. The TEXROPE V-Belt for most drives.

Oil-Resisting Super-7
Neoprene cover protects core against moderately oily or greasy conditions.

Oil-Proof Super-7
Made of Neoprene throughout. Use it when the belt must swim in oil.

Static-Resisting Super-7
Recommended where explosion hazard exists. Static-conducting element throughout cover won't wear off.

Super-7 Steel
Twin steel cables, to pull extremely heavy loads with minimum stretch.

GET THEM — through your Allis-Chalmers district office or dealer.

TEXROPE Super-7 V-Belts result from the cooperative research of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by A-C.

V-BELTS
TEXROPE complete line — Sizes, types for every power transmission problem and condition.

ALLIS CHALMERS
TEXROPE V-BELT DRIVES
ORIGINATORS OF THE MULTIPLE V-BELT DRIVE

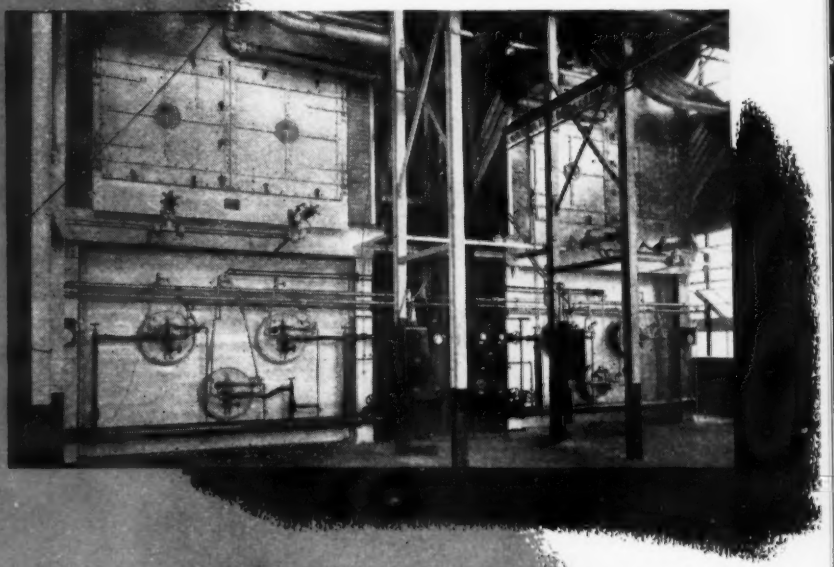
SHEAVES
"MAGIC-GRIP" . . . TEX-STEEL . . . TEXDRIVE . . . Speed changers and VARI-PITCH sheaves.

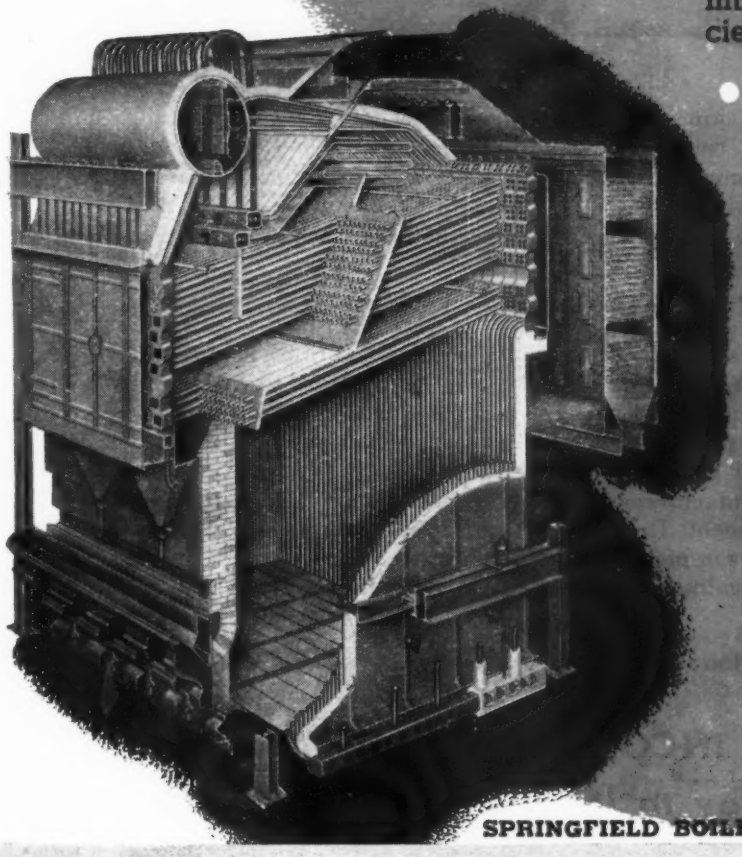
HEAR THE BOSTON SYMPHONY: *Every Saturday Evening, American Broadcasting Co.*

A 2009

Question: WHAT IS AN EFFICIENT STEAM BOILER?

An efficient steam boiler is one that has a high thermal efficiency—one that produces more steam per pound of coal—is easily operated at low cost, and is simple to maintain. If you want the answers to efficiency in a steam generating unit, check the SPRINGFIELD design and constructional features below.





- **Simplicity of over-all design** makes the unit reliable and easy to operate.
- **Staggered group tube arrangement** for maximum heat absorption and high thermal efficiency.
- **Single cross drum** for dry steaming and steady water level.
- **Cast steel boiler headers** (pioneered and developed by Springfield) provide stronger rolled tube joints, stronger headers, and protection against corrosion.
- **Convenient access to all parts** makes maintenance easy.

EXAMINE THIS UNIT. THESE FEATURES GIVE HIGH THERMAL EFFICIENCY: cross flow of gases, multiple pass arrangement, tight baffle construction, small diameter tubes, and efficient staggered tube arrangement.

THESE FEATURES REDUCE MAINTENANCE COSTS: simplicity of design, better header construction, more durable baffles, conservatively designed water walls, and ready accessibility to all parts of the unit.

Write for full information today.

SPRINGFIELD BOILER COMPANY, 1953 E. Capitol Ave., Springfield, Ill.

SPRINGFIELD

STEAM GENERATING UNITS

ANY SIZE ANY FUEL ANY PRESSURE

SPRINGFIELD BOILERS

Now... Precision Castings
in MONEL, NICKEL and INCONEL

You already know the many tough jobs that you've licked by using strong, hard, corrosion-resisting INCO Nickel Alloys.

Now... comes a development that *extends* the usefulness of these problem-solving alloys.

Precision castings are now being produced by INCO in Nickel, Monel, Inconel and other high-Nickel alloys.

That means designers and engineers can use these rustless alloys in complicated shapes which frequently were not practical or economical to obtain as sand castings or by machining from forged stock.

The illustration shows the flexible design possible. Note the holes, slots, undercuts, vanes, wing sections, gear teeth and threaded sections that can be produced with hair-tolerances and fine finish... *without machining or grinding.*

Both manufacturers and users of power plant equipment profit by this development. To the *manufacturer*, it means a chance to use INCO Nickel Alloys in more economical forms. To the *user*, it means broader protection against stress... corrosion... erosion... high temperatures ... abrasion.

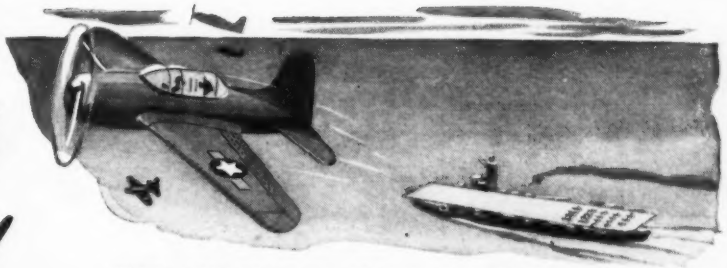
The International Nickel Company, Inc., 67 Wall St., New York 5, N.Y.

Precision Castings *in* INCO NICKEL ALLOYS
—a new way to lengthen equipment life

MONEL* • "K" MONEL* • "R" MONEL* • "KR" MONEL* • "S" MONEL* • INCONEL* • NICKEL • "L" NICKEL* • "Z" NICKEL

*Reg. U. S. Pat. Off.

Getting Navy Planes into Air Fast was Job for "Super" Motors!



"What We Want" said Navy, "are ½-hour rated elevator motors that'll lift planes from carrier hangar decks, up at 42 ft, down at 52 ft a minute. And they must be exceptionally dependable—under all conditions—because these planes have to be in the air when we need 'em!"

"Look, Here's What We're Using Now. Two standard winch motors on each elevator . . . doing a good job too. But we want something better. Because *two* motors mean extra space, weight and repairs — things we've got to cut down for more important ordnance."

Whew! High elevator speed, low motor speed . . . stronger . . . lighter . . . smaller — this'll take 6 months to design! Then we rolled up our sleeves, tackled first the problem of developing extremely high torque for fast starting under load — solved it with a special field.

How To Get Light Weight — yet maintain the generous motor design for which we are famous — presented still another problem. This one we solved by skilful substitution of copper for steel . . . of war-proved fabrication for casting. Yes, we cut down weight *and* maintained ample, generous design!

Came the Big Surprise! After we put on finishing touches — special corrosion-resistant marine parts, new kind of insulation — we added up design time . . . just one month! And much-needed motors were rolling off the lines less than 4½ months later.

A 1998

Significance: The creative engineering that goes into solving *special* motor problems, like this one, also points out new ways to build better *standard* motors for you! Watch for these new and better motors from A-C. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

Wait 'til you see the NEW

ALLIS-CHALMERS MOTORS!

HEAR THE BOSTON SYMPHONY: *Every Saturday Evening, American Broadcasting Co.*

you know you're buying BETTER EQUIPMENT

• The installation of Lunkenheimer Valves, Lubricators, or Air Devices on power equipment is an indication that the equipment itself is of *superior construction and efficiency*.

It's the quality-minded manufacturer who selects Lunkenheimer products for his equipment. He knows the Lunkenheimer reputation for correct engineering, advanced design, superior workmanship . . . he knows his equipment will give better performance with less trouble, when fitted with Lunkenheimer Valves or other devices.

He knows, in short, that his own product is thus given added salability, and in use will give the purchaser maximum results at minimum cost.

Whenever and wherever you purchase power equipment units, you'll be wise to look for the Lunkenheimer name on valves and lubricators—a *positive guide to value*.

THE LUNKENHEIMER COMPANY, Cincinnati 14, Ohio, U.S.A. (Offices: New York 13, Chicago 6, Boston 10, Philadelphia 7. Export Department: 318-322 Hudson Street, New York 13, N. Y.)

BRONZE, IRON, STEEL, AND CORROSION RESISTANT ALLOY VALVES
AIR DEVICES, LUBRICATORS, AIRCRAFT FITTINGS

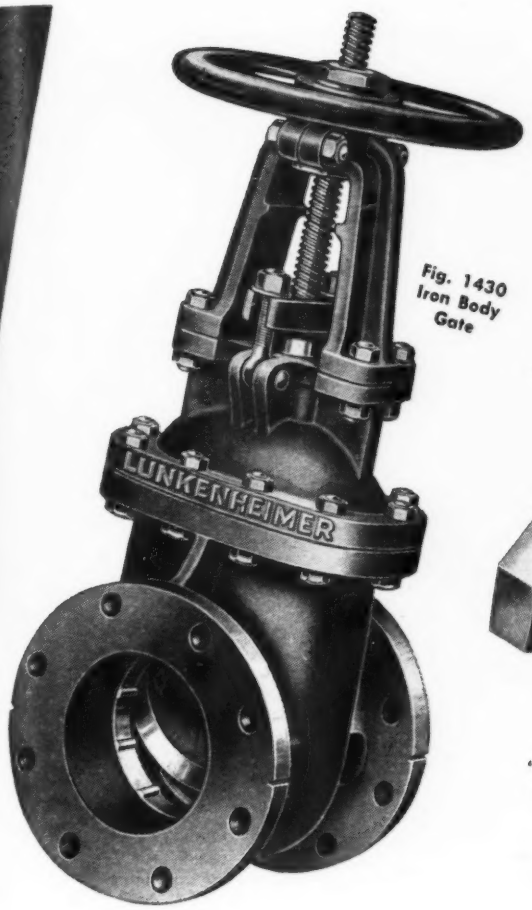


Fig. 1430
Iron Body
Gate

Fig. 16
"Renewo"
Globe

Fig. 2125
Bronze Gate

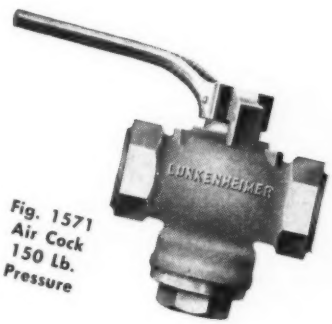


Fig. 1571
Air Cock
150 Lb.
Pressure

Fig. 1834
"Alvor"
Constant Level
Oil Control

PERHAPS YOU HAVE A PRODUCT THAT CAN BE GIVEN THIS ADDED SALES ADVANTAGE

- If your products require the use of valves, lubricators, air devices, or boiler mountings, the name Lunkenheimer on such equipment will provide extra sales appeal. For further information see your nearest LUNKENHEIMER DISTRIBUTOR.

LUNKENHEIMER VALVES

THE TEST TUBE POINTED TO A WORN REGULATOR

The first sign of trouble in an important industrial plant was the failure of a superheater tube. Analysis of the scale in this tube made it evident that carry over of boiler water was taking place. Hall engineers, plant personnel and the boiler manufacturer cooperated in locating and eliminating all possible causes of carry over, and the condition was quickly corrected.

Nevertheless the turbine strainer accumulated deposit which made cleaning necessary as frequently as once a week, and eventually the steam line became clogged with deposit.

Unless data on steam quality were misleading, carry over was stopped—but the deposits were there.

The Hall field engineer came to his home office, where the staff explored the whole situation. The key to the problem, they decided, was the composition of the deposit. When carry over was taking place, silica content had been high. Now, in the last deposit tested, sodium sulphite and sulphate made up more than 90% of the deposit.

There could be only one answer. Boiler feedwater, to which sodium sulphite was being added, must somehow be getting into the steam line. Such leakage could take place at only one point, they decided, and that was at the feed pump excess pressure regulator.

The Hall field engineer returned to the plant and, with the power house engineer, checked the regulator. They found that the sodium sulphite chemical feed line was connected into the feedwater control line to the regulator, which was of the old piston type. Water containing the chemical was leaking past the piston, through the steam control line and into the steam line.

The plant lost no time in connecting the sodium sulphite chemical feed line directly into the main boiler feed line, and in ordering a new diaphragm type excess pressure regulator. These changes ended the trouble, and removed a probable source of serious interruptions in service.

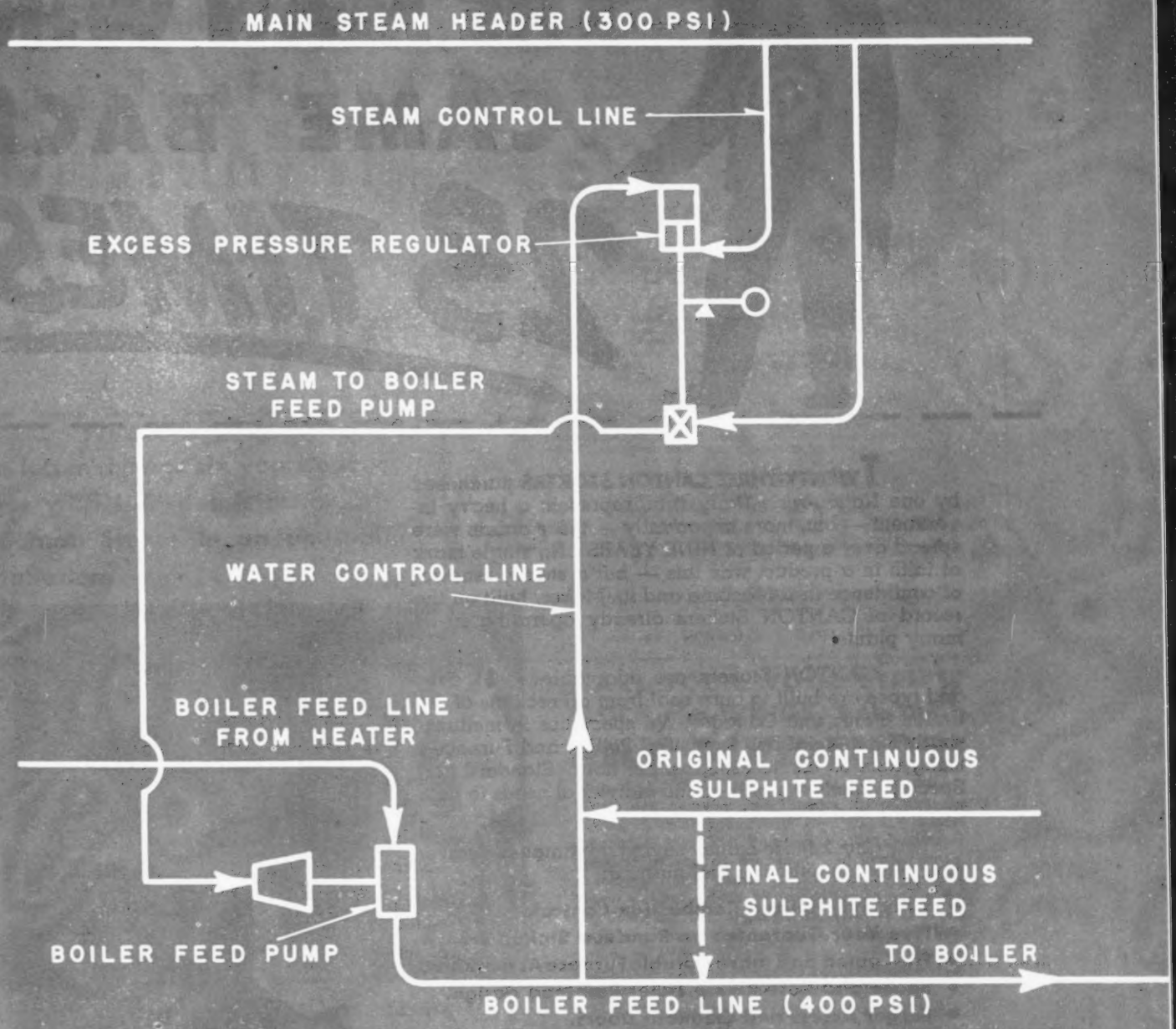
When procedures set up by Hall Laboratories are carefully followed, boiler water troubles come close to the vanishing point. When trouble does occur—usually, as in this instance, because of some unusual quirk in the boiler room equipment—Hall engineers trace that trouble to its source and show how to correct it.

Every plant that generates its own steam can profitably use Hall Service. We will be glad to send you full information.

HALL LABORATORIES, INC. • HAGAN BUILDING • PITTSBURGH 30, PA.

(A subsidiary of Hagan Corporation)

HAGAN
HALL
BUROMIN
CALGON



HALL SYSTEM *of Boiler Water Conditioning*

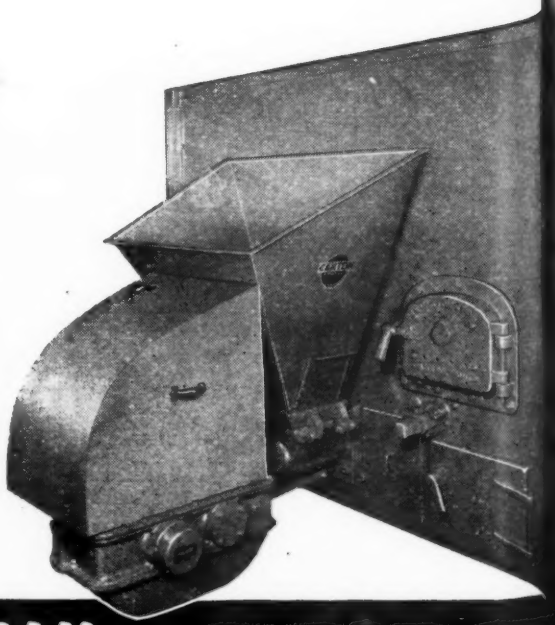
THE MAN WHO CAME BACK 23 TIMES

TWENTY-THREE CANTON STOKERS purchased by one Nation-wide Dairy firm, represent a heavy investment — but, more importantly — these orders were spread over a period of NINE YEARS! No single mark of faith in a product was this — but a steady renewal of confidence in a Machine and its Maker, built on the record of CANTON Stokers already operating in its many plants!

CANTON Stokers are adaptable — 54 sizes and types are built to burn coal from all sections of the United States and Canada. We specialize in medium-sized Commercial and Industrial Boilers and Furnaces, using from 50 lbs. to 3200 lbs. per hour. Standard and Special Models are built to suit individual needs in both Ramfeed and Wormfeed designs.

Check these money-saving advantages against your present method of fuel burning:

- **Fully Sychronized Combustion Control.**
- **Five Year Guarantee on Ramfeed Stoker Drives.**
- **Fin-Cooled and more durable Furnace Assemblies.**
- **Space and Cost-saving LoSet Ramfeed design.**
- **Larger Access and Cleanout Doors.**
- **Fan Flexibility — side, rear, or front settings with unit or separate motor drives.**
- **Controls mounted on Steel Panels — pre-wired at Factory.**
- **Engineered to burn Bituminous, Semi-Bituminous, and Anthracite Coal or Combination Wood and Coal.**



CANTON STOKERS

CANTON IS THE *ONLY* STOKER GUARANTEED 5 YEARS AGAINST DEFECTS AND WEAR

. . . and another example of the adaptability of Cantons on the job everywhere

This letter reports six years operation, with 100% satisfaction, of a Canton Stoker in an unusual installation.

"Home of the Quick and Slick Sellers"

WILLIAMSBURG CHAIR FACTORY *Manufacturers of* **Chairs** *of Finest Quality*

P. O. BOX No. 88
WILLIAMSBURG, OHIO
PHONE 4042

STURDY AS THE OAK

WHEN REPLYING MARK FOR ATTENTION OF
N. J. White

Manufacturers
NURSERY CHAIRS
CHAIRS
SAFETY-BILT HIGH CHAIRS
BABY ROCKERS
BREAKFAST SUITES
DINETTE SUITES
BUFFETS & CHINAS
DESK CHAIRS
KITCHEN CHAIRS
UNFINISHED CHAIRS

19 March 46

Canton Stoker Corp.
Canton, Ohio

Gentlemen:

We are pleased to advise you that the stoker you installed in our plant in 1939 has given us 100% satisfaction.

We have used this stoker day and night ever since it was installed and have never had any trouble with it. Also the service you have given us has been wonderful.

We also want to add that you can use wood as well as coal in this stoker and it can be hand-fired, if necessary. The shavings and saw dust comes direct from our machinery through our blower system into our furnace and this goes into our furnace at the same time the stoker is working.

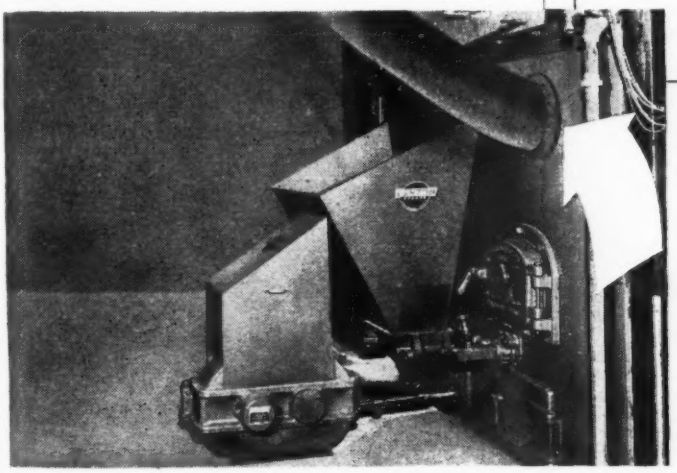
We are also pleased to tell you that this stoker paid for itself in less than one year in labor and fuel and we do not have to worry about our steam pressure not being right on the dot. Our pressure doesn't vary much more than a pound at any time.

When the war is over we contemplate installing another one of your stokers and we can recommend it 100%, workmanship, durability and efficient cost of up-keep. We are well pleased with this stoker.

Yours very truly,
Williamsburg Chair Factory
N. J. White

NJW:RM

FOUNDED BY WHITES' IN 1879



MAKE YOUR WOOD STRIPS, BLOCK, SHAVINGS, SAWDUST PAY DIVIDENDS!

With CANTON'S unique Control System, Wood Waste can now be economically and effectively burned in combination with Coal. The Waste is exhausted into the Furnace under centrifugal pressure as fast as produced, and burned to recover valuable heat. CANTON'S Sychronized Stoker Control stands by, speeding up and slowing down the Coal input as the quantity of Wood fired decreases and increases. Maximum heat value of Wood Waste is recovered — Coal is conserved — Steam Pressures held constant — and Manual Labor is rendered unnecessary!

Ask for Factual Survey TODAY — no obligation.

CANTON STOKERS

CANTON STOKER CORPORATION

741 ANDREW PLACE, S. W., CANTON, OHIO

GENTLEMEN:

Please send me at once bulletins checked below:

☐ No. 203 VULCAN (Industrial) ☐ No. 400 LO-SET Heavy Duty
☐ No. 500 DURAFLEX (Light Industry and Commercial)
☐ Arrange interview with Canton Engineer at once

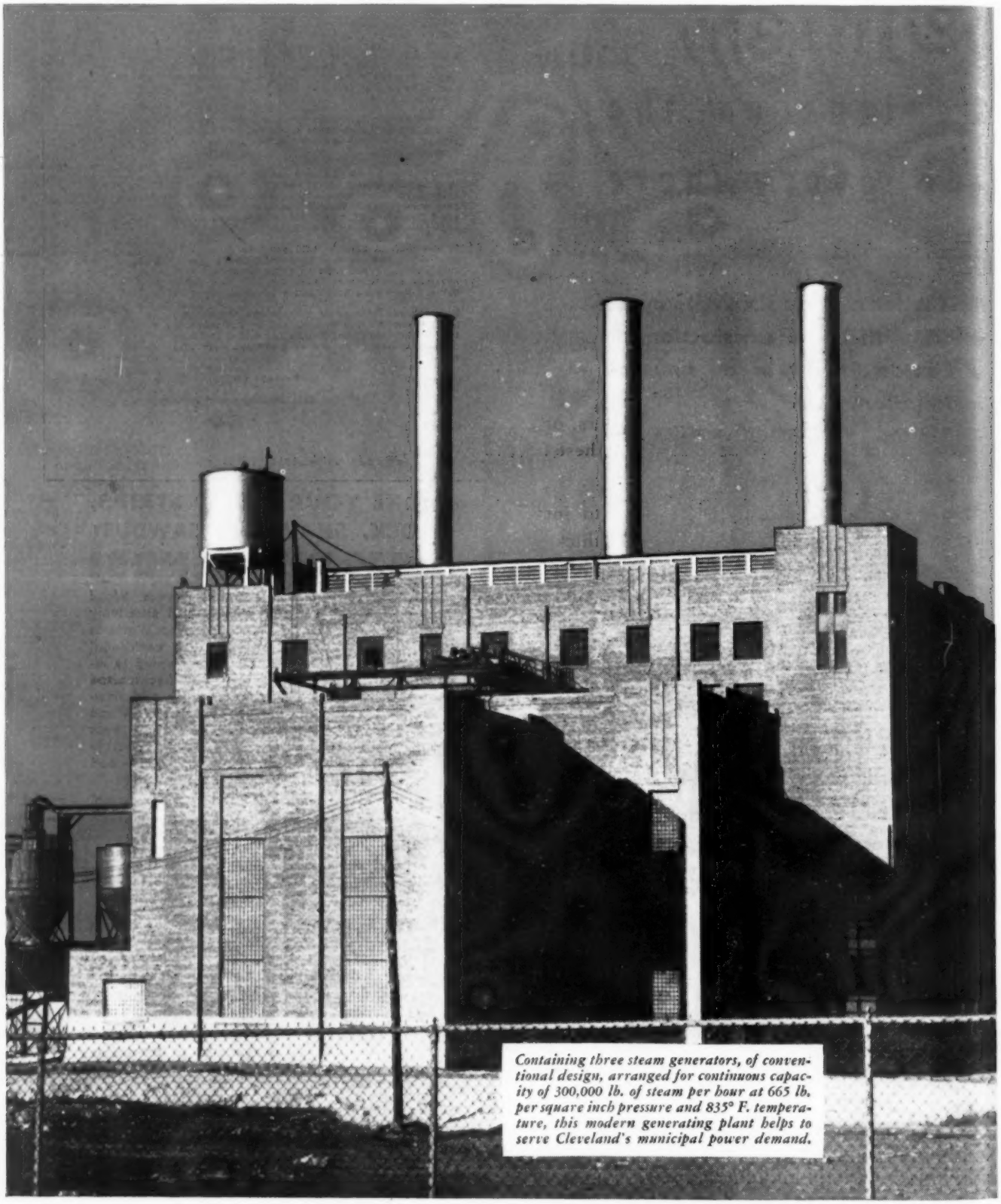
*Name*_____

*Company*_____

*Address*_____

*City*_____ *Zone*____ *State*_____

In Cleveland



Containing three steam generators, of conventional design, arranged for continuous capacity of 300,000 lb. of steam per hour at 665 lb. per square inch pressure and 835° F. temperature, this modern generating plant helps to serve Cleveland's municipal power demand.

it's ELECTRUNITE

. . . NOW IN SIXTH YEAR OF SERVICE

AT GIANT MUNICIPAL LIGHT PLANT

Day in and day out, Republic ELECTRUNITE Boiler Tubes—139,938 feet of them—are delivering dependable, low-cost service in the steam generators of Cleveland's newest Municipal Light Plant.

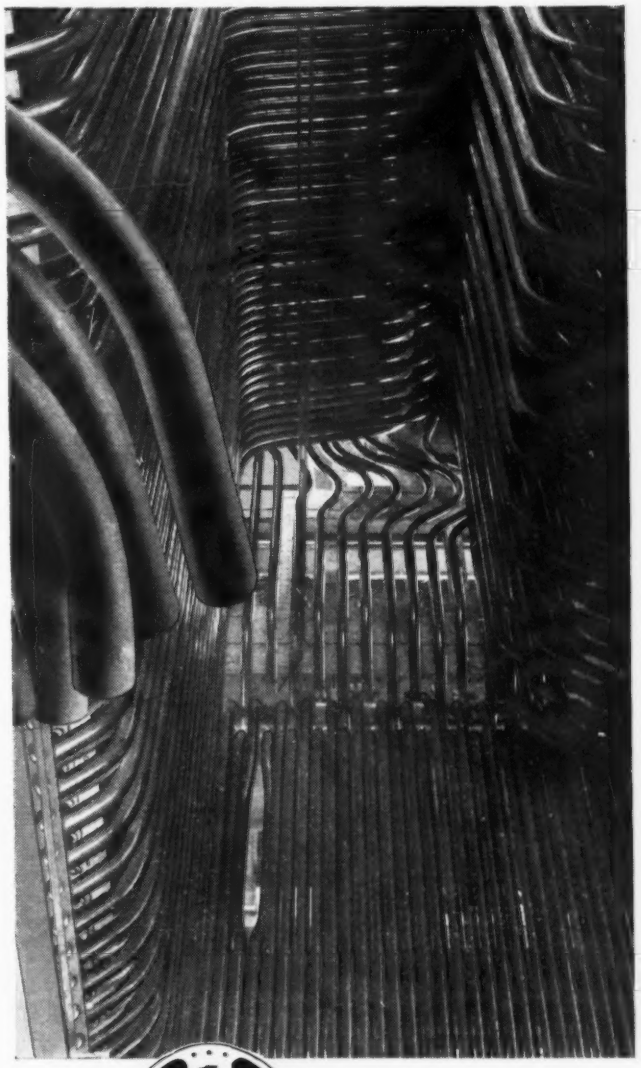
When this plant was erected in 1940, it added one more to an already impressive list of installations in which ELECTRUNITE Tubes were included as original equipment. Today, it provides additional evidence of the safety and dependability of these *modern* electric resistance welded boiler tubes.

Whether you specify tubing for new boilers, or for re-tubing of existing equipment, consider these facts before you choose:

ELECTRUNITE Boiler Tubes are easy to install, because they *always* are uniform in wall thickness, diameter and concentricity . . . highly ductile, because every tube is full normalized throughout its entire length . . . and reliable in service, because they are free from corrosion-inviting scale and scale pits. Strength and soundness are assured by hydrostatic testing of each tube at pressures in excess of code requirements.

You can't afford shut-downs and high maintenance costs—but you can afford Republic ELECTRUNITE Tubes. For complete information, write to:

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, New York



MID AMERICA EXPOSITION CLEVELAND

REPUBLIC STEEL SERVES THE WORLD

Republic
ELECTRUNITE
Reg. U. S. Pat. Off.
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

NO. 3

Helpful Hints on Applying Capacitors

To help you improve power factor, reduce kva demand, increase circuit loadability and, often, reduce power costs.

HOW CAPACITORS ARE APPLIED TO MOTORS TO IMPROVE POWER FACTOR

Improvement of power factor is often most effectively done by applying capacitors directly to the terminals of the individual motors, and switching motor and capacitor as a unit. As the "non-working" current (reactive kva) is then supplied on the spot, there is a reduction in the current flowing to the motor for any given load or overload. Therefore, it is important to make certain that there is adequate motor overload protection after the capacitors are applied.

In many cases it is necessary to change the heater units in the motor thermal relays on the basis of the reduced current of the motor-capacitor combination, as contrasted with the motor current alone.

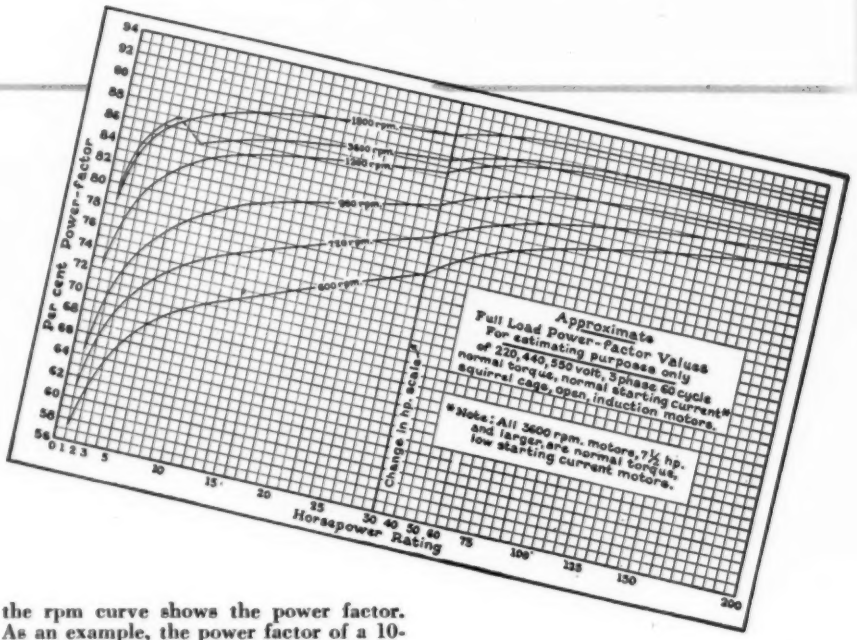
When capacitors are connected to the motor terminals directly, and are switched with the motor, it is recommended that the capacitor kva be no more than is necessary to improve the power factor to approximately 95 per cent. Excessive capacitor kva may cause overvoltage on the motor during deceleration after the switch is opened.

SHORT CUTS TO THE RIGHT CAPACITOR KVA

In applying capacitors, it is always possible to calculate exactly the correct kvar (kilovars) if the full-load power factor, the horsepower, the efficiency, and the kw load of the motor are all known. However, the short-cut method given here is a time saver, particularly when there are a number of cases to be worked out, and gives results accurate enough for most applications.

POWER FACTOR

The above chart gives the power factor of any squirrel-cage motor, regardless of the manufacturer, accurately enough to show the possibilities for improvement by adding capacitors. The point where the horsepower line intersects the rpm curve shows the power factor. As an example, the power factor of a 10-hp, 1200-rpm motor is 84.5 per cent.


Per cent Power-Factor
Horsepower Rating
Change in hp. scale
3600 rpm
1800 rpm
1200 rpm
900 rpm
720 rpm
600 rpm
Approximate Full Load Power-Factor Values
For estimating purposes only
of 220, 440, 550 volt, 3 phase 60 cycle normal torque, normal starting current* squirrel cage, open, induction motors.
*Note: All 3600 rpm. motors, 7½ hp. and larger, are normal torque, low starting current motors.

CAPACITOR KVA (KILOVARS)

The table shows the standard capacitor kva ratings in kilovars recommended for use with various standard motors. For example, the 10-hp motor referred to would require a 4-kva capacitor. The table also shows, under the heading Per Cent AR, the resulting per cent reduction in line current and is helpful in choosing the proper heater unit for thermal overload relays located on the line side of the capacitor.

Additional capacitor application data may be obtained by writing for Bulletin GEA-3225A. For product data on Pyranol capacitors to improve power factor, ask for Bulletin GEA-2742C. *Apparatus Dept., General Electric Co., Schenectady 5, N.Y.*

Maximum capacitor rating when capacitor and motor are switched as a unit

Induction Motor HP Rating	MOTOR SPEED IN RPM					
	3600		1800		1200	
	Kvar†	% AR ††	Kvar	% AR	Kvar	% AR
10	2.5	9	4	11	4	12
15	2.5	9	5	11	5	11
20	5	9	5	10	5	11
25	5	9	7.5	10	7.5	10
30	7.5	9	10	9	10	10
40	10	9	10	9	10	10
50	12.5	9	12.5	9	12.5	9

Data for Three-phase 60-cycle Open Induction Motors of 220-, 440-, 550-, and 2300-volt Rating.

† Kvar is rated kilovolt-amperes of capacitors connected at motor terminals.

†† Per cent AR is per cent reduction in line current due to capacitors.

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Ordinarily, it is no compliment to say a man has a "one-track" mind. But in the special sense in which we apply the term to S-A engineers, it describes a singleness of purpose that saves American industry countless thousands of dollars on bulk material handling operations.

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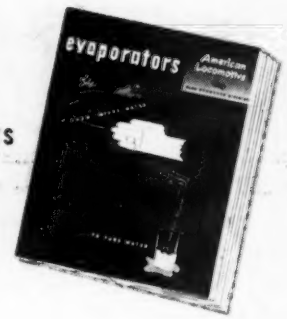

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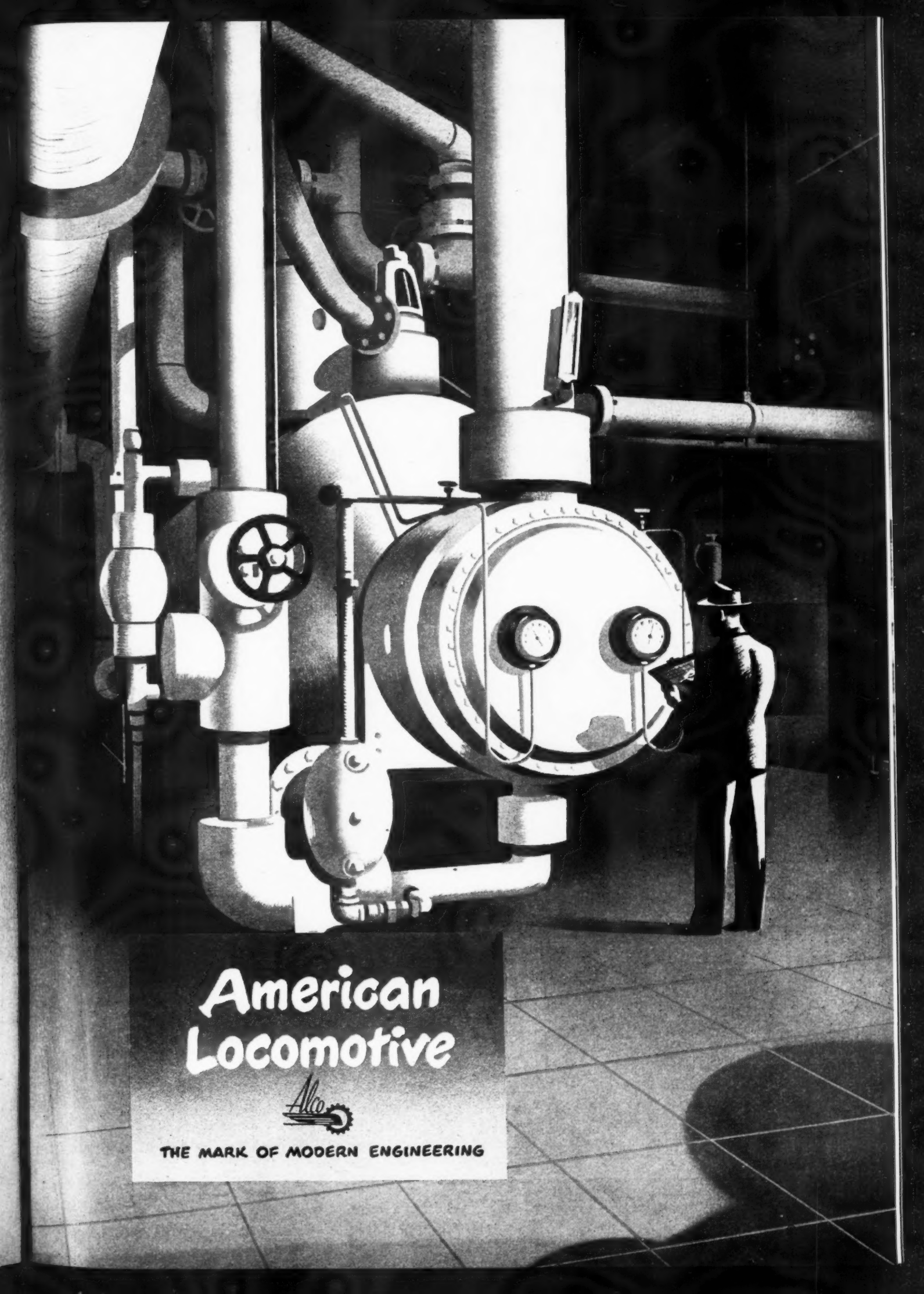
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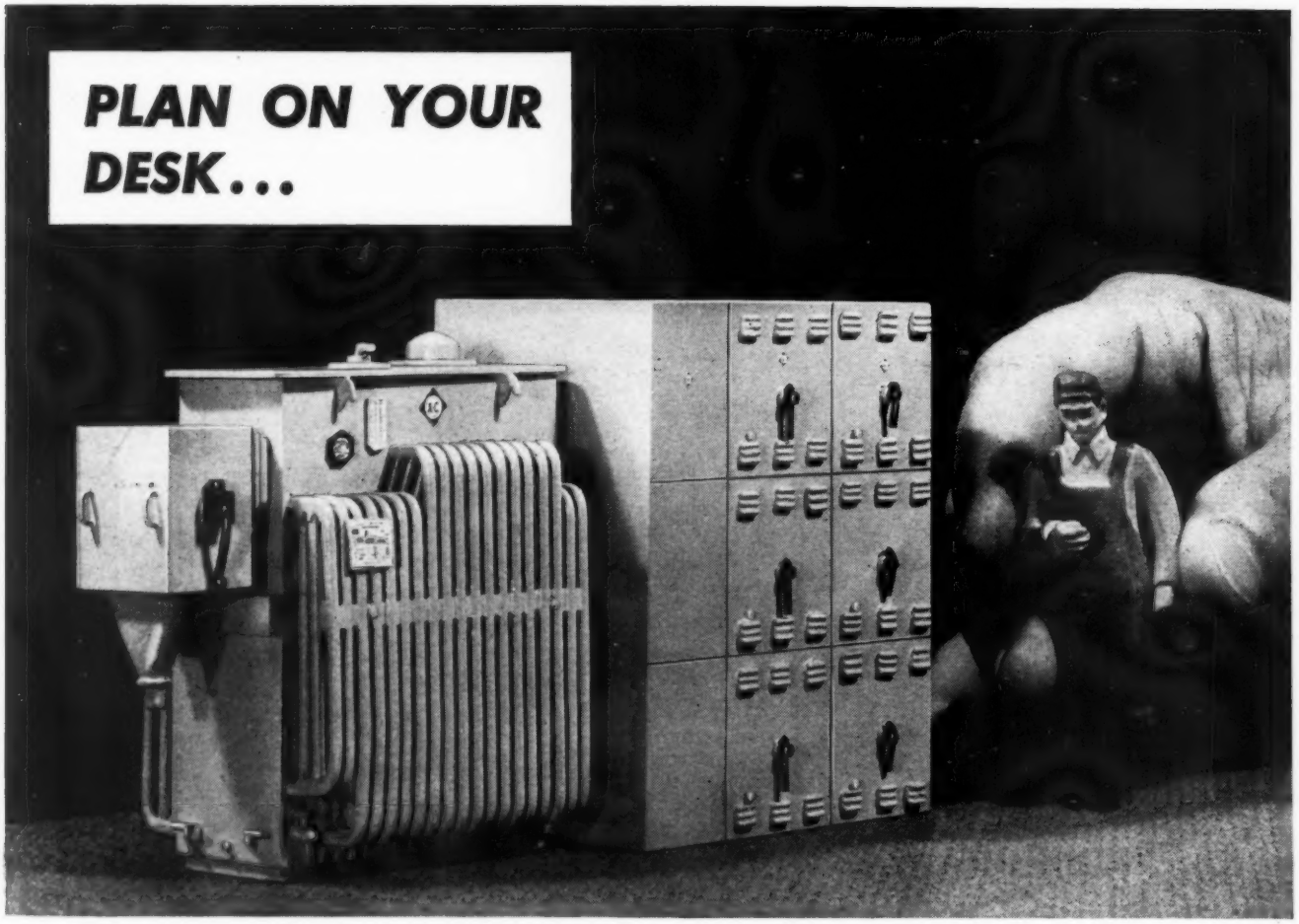

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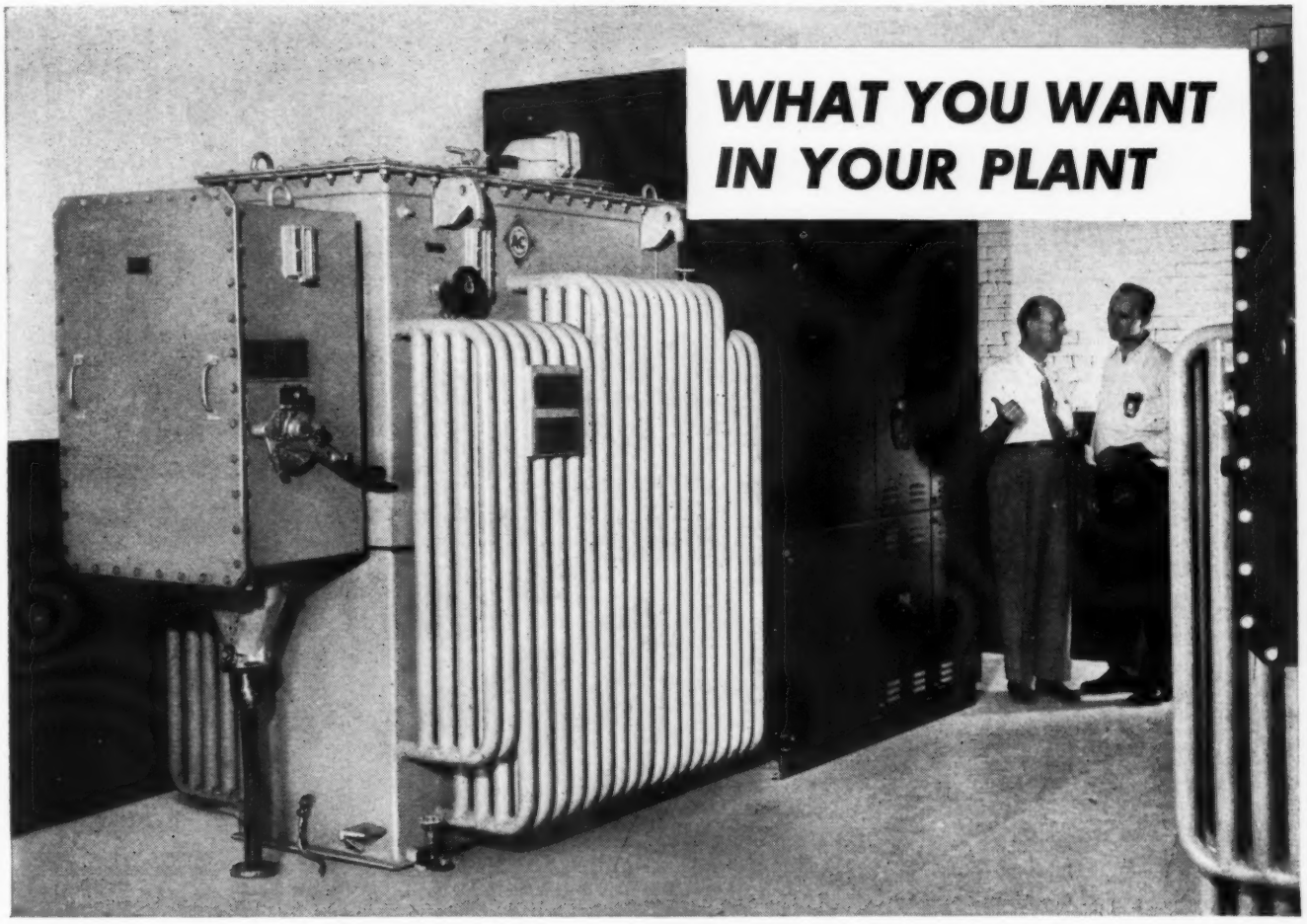

and Buy Right!

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Catalogs and detailed information will be gladly furnished on request. If you have any unusual flow control problems, Powell Engineering is always at your service to help you solve them.

Fig. 3003 W. E.

Fig. 3003 W. E.—Class 300-pound Cast Steel Gate Valve with welding ends, outside screw rising stem and bolted flanged yoke.

Fig. 9061 W. E.

Fig. 9061 W. E.—Class 900-pound Cast Steel Swing Check Valve with welding ends and bolted cap. Disc is hung on a 5-degree angle and, when wide open, permits full unobstructed flow through the valve body.

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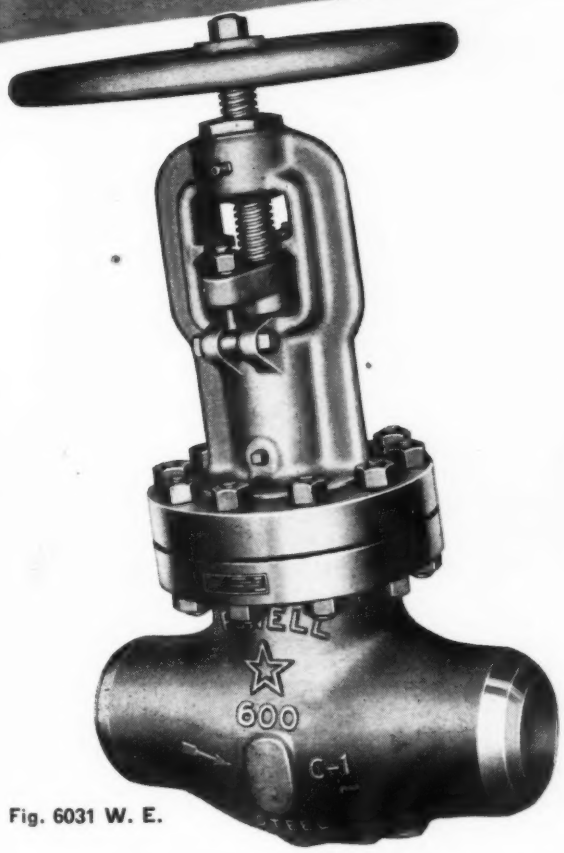

Fig. 6031 W. E.

Fig. 375

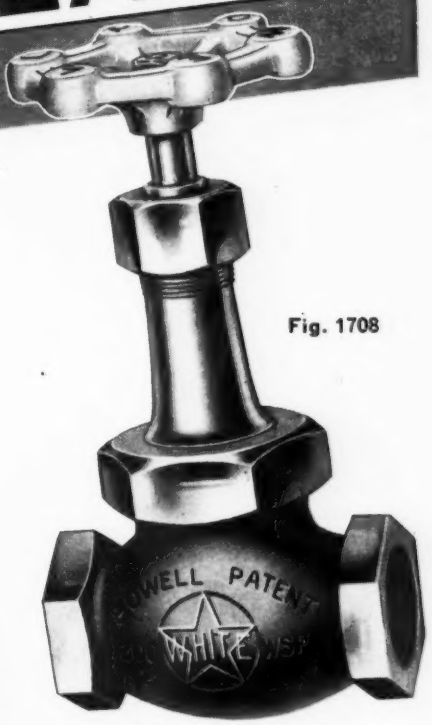

Fig. 1708

Fig. 386

Fig. 6031 W. E.—Class 600-pound Cast Steel Globe Valve with welding ends, outside screw rising stem and bolted flanged yoke.

Fig. 375—200-pound Bronze "White Star" Gate Valve with screwed ends, inside screw rising stem, union bonnet and renewable, wear-resisting "Powellium" disc.

Fig. 1708—200-pound Bronze "White Star" Globe Valve, with screwed ends, union bonnet, renewable seat and regrindable, renewable, wear-resisting "Powellium" semi-cone plug type disc.

Fig. 386—200-pound Bronze "White Star" Gate Valve, with screwed ends, outside screw rising stem, screwed-on yoke and bonnet, and renewable, wear-resisting "Powellium" seat rings and disc.

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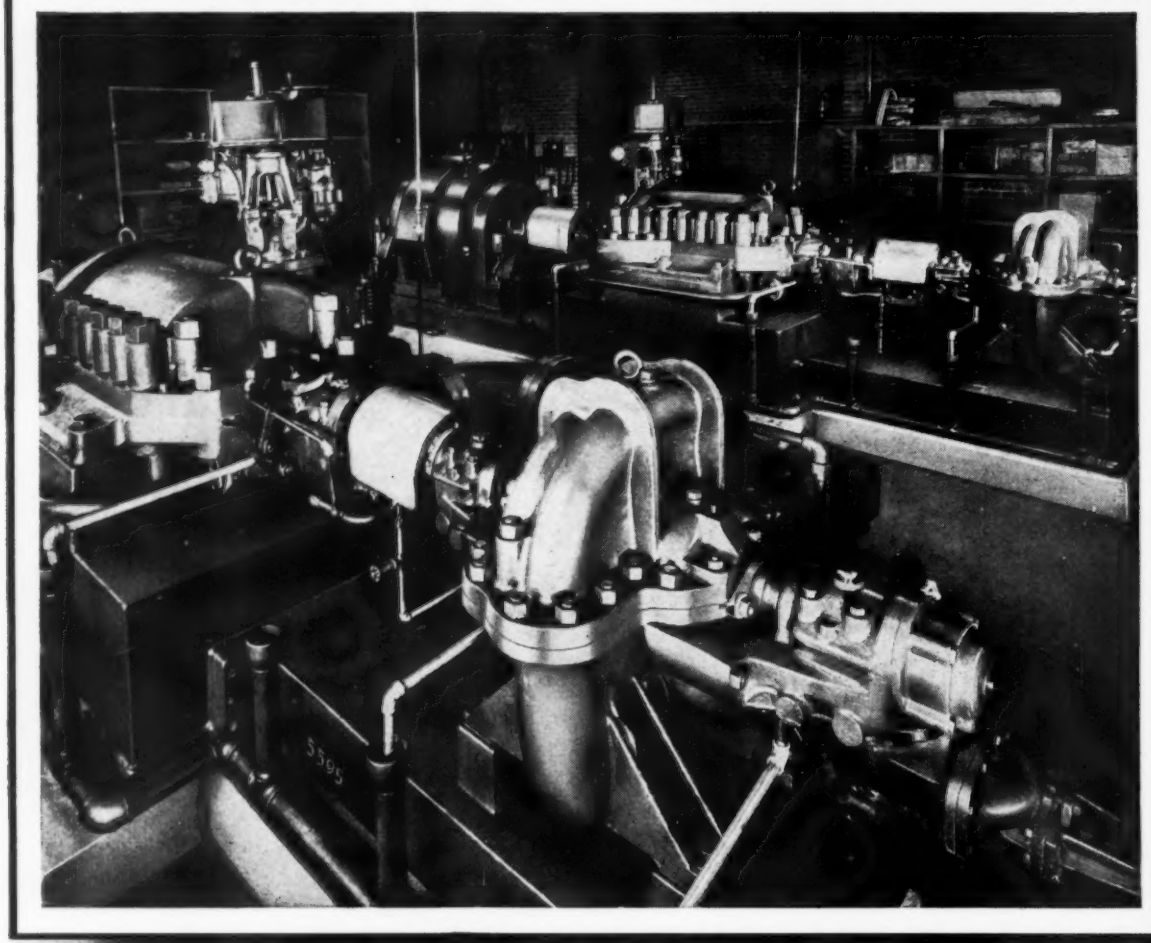

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3240

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APRIL, 1946 VOLUME 90, NUMBER 4

A CROSS-INDEX OF SUBJECTS FOR THE MONTH

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STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
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TRANSMISSION, LUBRICATION
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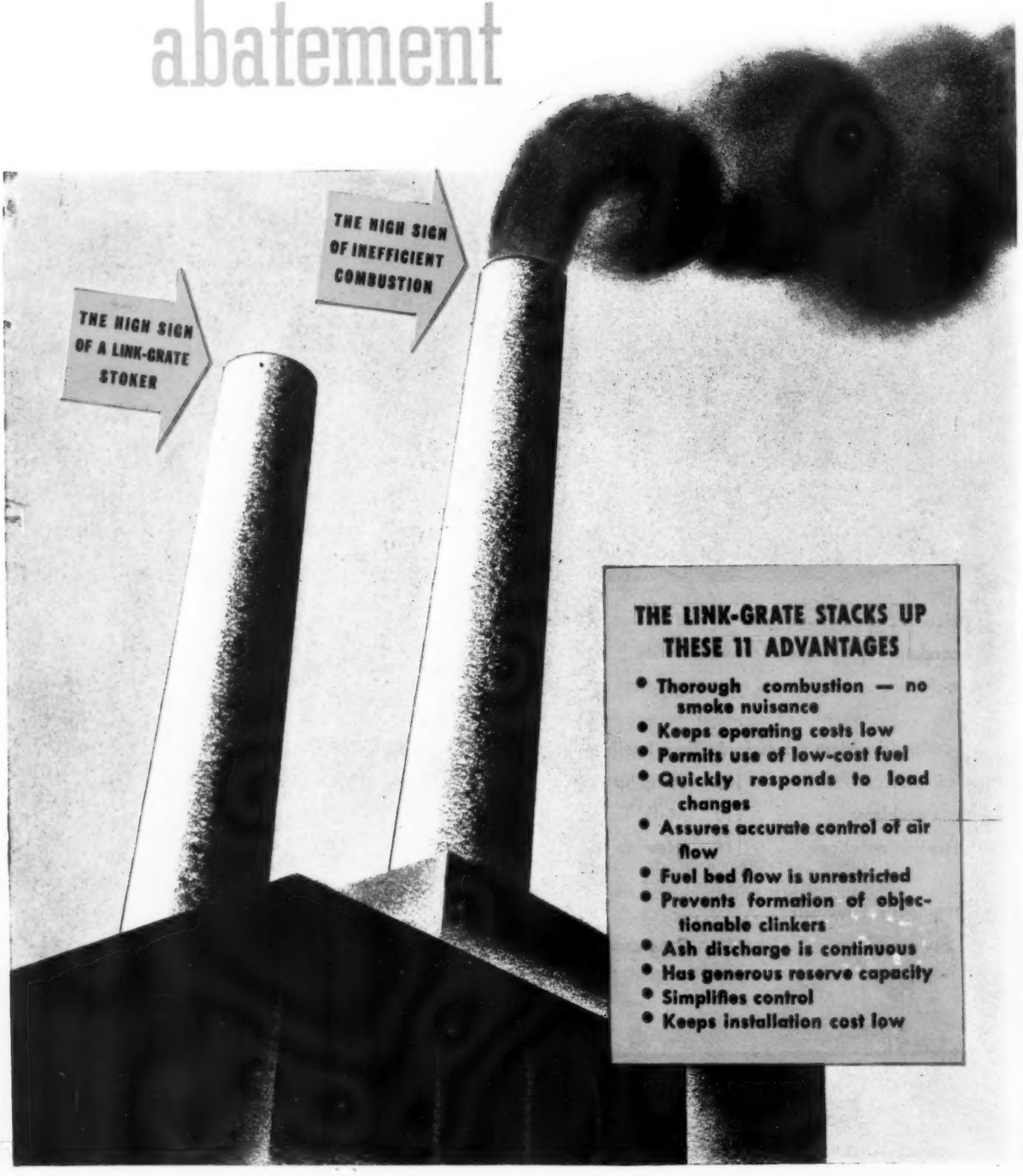
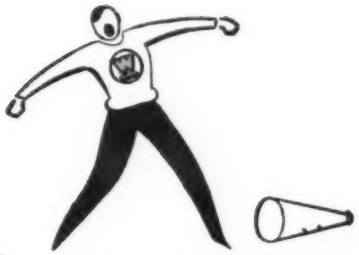
Three cheers for smoke abatement

1...from your fuel cost sheets



THE LINK-GRATE STACKS UP THESE 11 ADVANTAGES

- Thorough combustion — no smoke nuisance
- Keeps operating costs low
- Permits use of low-cost fuel
- Quickly responds to load changes
- Assures accurate control of air flow
- Fuel bed flow is unrestricted
- Prevents formation of objectionable clinkers
- Ash discharge is continuous
- Has generous reserve capacity
- Simplifies control
- Keeps installation cost low



2...from your Smoke Inspector

3...from your neighbors

Get all 3 with a Westinghouse Link-Grate Stoker

Smoke abatement means much more to you than to an outsider interested only in cleanliness. To you, it means more steam per pound of coal—more of your coal turned into heat, and less of it "up the flue" as soot.

You get these advantages with a Westinghouse Link-Grate Stoker because of its characteristic action. This action maintains a regular combustion rate by continuously processing the fuel bed to keep it porous. With this action, a positive motion at the rear of the stoker permits a uniform flow of coal over the underfeed section, to keep the burning lanes open.

In Link-Grate action, the grates first hinge upward to break open the fuel bed and let low-pressure air flow through the grates. The reverse movement of the grates crumbles and conveys the burning fuel.

Another effect of this Link-Grate action is the continuous ejection of the ash off the discharge plate—to do away with periodic dumping and to reduce labor costs. Clinkers are not a problem.

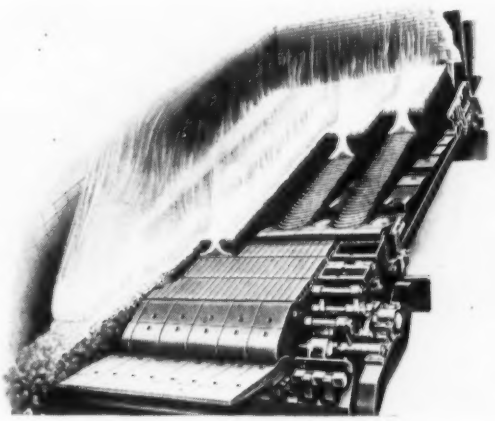
Since this action keeps the fuel bed always porous, the Link-Grate Stoker can meet suddenly increased steam demands quickly with full combustion efficiency.

Get the complete information about the Link-Grate before you make another investment in stokers. If possible, see one in operation. Your nearest Westinghouse office will be glad to arrange an appointment with a user. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-50470

Show Link-Grate Movies in Your Own Office

A 15-minute sound moving picture has been produced to show in detail the operation of a Link-Grate Stoker. Whether you can visit an actual Link-Grate Stoker in operation or not, this interesting 16 mm. film will show you its action and explain its points of superiority while you sit at your desk. To borrow a print of this film for your own private showing, write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.



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PLANTS IN 25 CITIES... OFFICES EVERYWHERE

Link-Grate STOKERS

This stack replacement was *BYERS WROUGHT IRON* to postpone the *next* one

The Palmer Match Company of Akron, Ohio, recently found that its stack built in 1938 of low-first-cost material, was due for replacement. With the wise idea of postponing the next replacement as far as possible into the future, the General Superintendent selected wrought iron for the replacement. The new stack was fabricated of Byers Wrought Iron 3/16-inch plates by Miami Boiler and Machine Company of Akron.

Engineers all over the country have been successful in extending the life of unlined metal stacks—in services where the use of this type of stack was justified—by changing to wrought iron. One Baltimore company that had obtained 5 years service from an ordinary stack reported that the wrought iron replacement was "standing up very well . . . requiring no replacement other than outside painting once in a while" after 9 years use. A Chicago company obtained approximately four times the service from their wrought iron stack that they had averaged from stacks made from low-first-cost material. These examples are typical of many such comparative experiences.

Because any moisture present in the gases absorbs carbon and sulfur compounds and forms acids, every metal stack is subject to corrosive attack. Wrought iron's superior resistance to this attack is due to its unusual structure and composition. Tiny fibers of glass-like silicate slag are threaded through a body of high-purity iron. Corrosion is halted and dispersed by this network of fibers, discouraging the pitting and rapid penetration that causes ordinary materials to fail. The fibers also anchor the initial protective scale, which shields the underlying metal.

If you have any stack replacements in prospect, it will pay you to investigate the possibility of longer service life through the use of wrought iron. You will find some helpful information in our bulletin, "Wrought Iron for Flue Gas Conductors and Coal Handling Equipment." We will be very glad to send you a copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco, Atlanta.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

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TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE ALLOY STEELS · OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

Measuring and Controlling TEMPERATURE and PRESSURE

By **E W FELLER** *Associate Editor*

It is the power engineer's job to keep many fluids in line. In particular, he must know and control the pressure and temperature of his steam, hot and cold water, refrigerants, brine, compressed air and conditioned air — also of the many process fluids closely associated with his power services.

To help him do this job right POWER presents this 58th special section devoted in part to the fundamentals but more largely to the actual devices available to register pressure and temperature, and keep them where they belong with a minimum of human attention.

This is a practical manual for the man in the plant who needs fingertip information for quick, sound solution of metering and control problems.

APRIL 1946 POWER P W SWAIN, EDITOR

Pressure Elements

Since measuring pressure is one of the most necessary functions in power and industrial plants, instruments are designed that exactly fit each job.

A pressure gage may need protection in many processes because the device's vital measuring element is usually exposed to the fluid whose pressure is being measured. For instance, the fluid may seriously corrode the measuring element, solidify at ambient temperature, or deposit heavy compounds that plug the line. Moreover, violent pressure pulsations may destroy accuracy, cause serious wear in linkages and delicate gears, as well as fatigue-failure of the elastic member.

The many instruments that meet varied plant needs are classified as having pressure that (1) acts on a known area, as in liquid-column manometers, bell gages and spring- or weight-loaded piston gages (2) produces deformation in an elastic member, as with bourdon tubes, diaphragms and bellows, or (3) causes change in physical properties, as in hot-wire and piezoelectric gages.

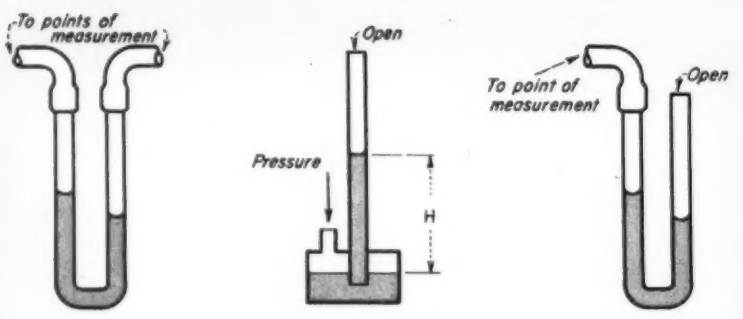
Simplest and oldest way to measure pressure is to balance it against a resisting force whose magnitude can be measured. For example, water weighs 62.4 lb per cu ft and since pressure is usually measured in psi you divide 62.4 by 144 to find that a 1-sq-in. column of water 1 ft high weighs 0.434 lb. This is the pressure it exerts at its base. If you insert a glass tube in a pail of water and suck on the open end until water rises to a height of one foot in the tube it indicates that atmospheric pressure acting on the water surface in the pail is 0.434 psi greater than that acting on the open end.

Since most pressure gages register the difference between two pressures (atmospheric and the one being measured) they are differential gages. This term, however, usually applies only to instruments operating on the U-tube principle—those measuring the difference between two pressures, both separate and distinct from atmospheric, Fig. 1.

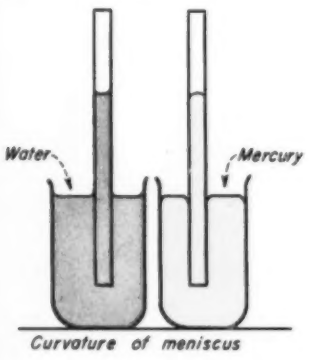
A liquid column, Fig. 2, is the standard device to check the accuracy of other pressure-measuring instruments. It is a tube filled with liquid that exerts at the base a pressure which varies directly with liquid-column height *H*. Mercury serves for vacuum and high pressures or pressure differentials while kerosene, glycerin, water, alcohol or other liquid that is not too volatile is used for low pressures.

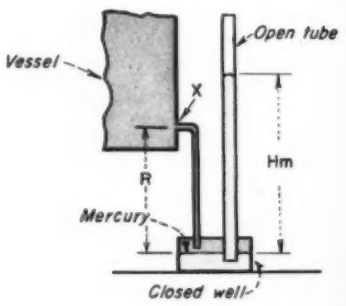
Lowest presssure that a liquid column can measure is the liquid's vapor pressure, upper limit being set only by the practical working height of the column. For high pressures where extreme height becomes inconvenient, several short columns are connected in series. Here a column of less dense liquid (water) transmits pressure from the top of one mercury column to the bottom of the next. Total pressure reading equals the sum of mercury-column heights minus the sum of water-column heights.

In an open U-tube, Fig. 3, difference in height of the two liquid legs is a direct measure of the pressure (in comparison with that of the atmosphere) acting at the point of attachment to the tank, pipeline or other vessel.



1 Simple U-tube that measures differential pressure between two points. 2 The liquid column is a standard to check the other measuring instruments. 3 U-tube containing water serves to measure draft or check draft gages





4 Meniscus shape depends on whether or not tube surface is wetted by the liquid serving as the measuring fluid 5 Liquid head *Hm* measures pressure acting at point *X* when densities of fluids in legs *R* and *Hm* are known

SURFACE TENSION

A well gage, Fig. 2, differs from the U-tube only in that one leg is replaced by a chamber, which is made large so the liquid remains at practically constant level regardless of how high it stands in the tube. For precision work, consideration must be given to change in chamber level and curvature (meniscus) caused by the liquid's surface tension in both tube and well, Fig. 4.

Determining vessel pressure with a liquid column is easy when density of manometer fluid and fluid being measured is known, together with the tube level and distance between point of measurement and well level. Using Fig. 5 the equation is:

$(Hm \times pm) - (R \times pa) = P$

Where:

P = pressure (psi) acting at point *X*.

Hm = height of mercury column, in.
R = height between mercury surface and point of pressure measurement, in.
pm = density of mercury, lb per cu in.
pa = density of fluid having its pressure measured, lb per cu in.

When pressure of air or other gas having negligible weight is measured, Rpa factor can be disregarded except for precision work. But for a liquid or gas that requires a sealing liquid the complete equation must be followed.

For a required precision when measuring small pressures magnify the reading by: (1) using a fluid of different density (2) substituting an inclined U-tube (3) providing one leg with a reservoir of much larger bore than the tubing (4) using a 2-fluid U-tube.

INCLINED TUBE

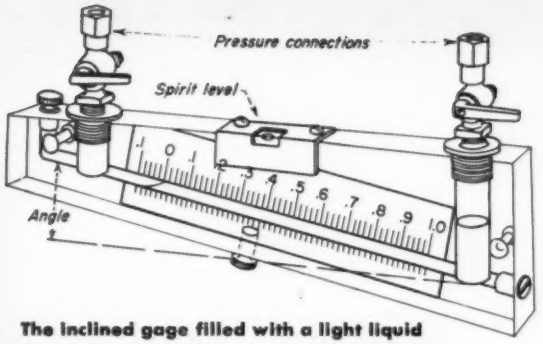
An inclined tube, Fig. 6, measures boiler draft and static pressure in air-conditioning systems to advantage because increase or decrease in vertical-liquid height, Fig. 7, causes the level to move in the inclined tube a distance equal to (vertical-liquid height) x (cosecant of the angle sloping tube makes with horizontal position). Thus if an angle's cosecant is 10 a change in vertical-liquid height of one inch shows up as 10 in. in the inclined tube. The gage can be graduated to 0.01 in. For low-pressures an oil considerably lighter than water serves as the filling agent, which permits lengthening the scale still farther. These instruments have a spirit level to assure correct positioning of the tube. A connection at either end facilitates using the tube to measure pressure above or below atmospheric or a pressure difference between two points. However, this device is not readily adaptable to recording duty.

A liquid-sealed bell, Fig. 8, can replace the inclined U-tube to indicate, record or control pressure. In a single-bell unit a spring, weight or float balances the bell, and pressure to be measured is applied to its underside. Bell movement then positions a pointer, pen or controller. Double-bell device, Fig. 9, measures differential pressure; one of two pressures being applied under each bell. The instrument becomes a recording flowmeter when connected across a boiler pass or between furnace and last pass, the scale being calibrated accordingly. Frequently a gas-temperature thermometer and steam-flow indicator mount inside the same case so the chart records steam flow, air flow and uptake temperature.

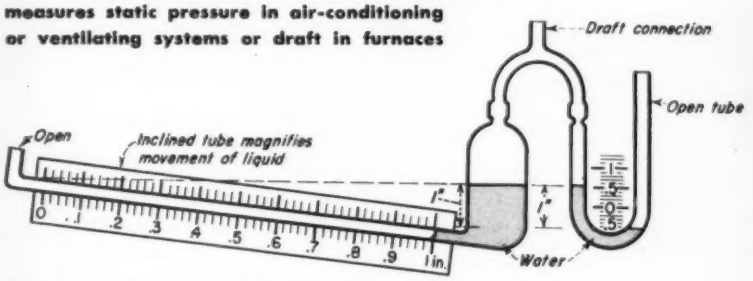
A closed column, Fig. 12, measures absolute pressure directly, provided the space in the closed end is substantially a perfect vacuum. A typical example is the barometer, which measures absolute pressure of the atmosphere in terms of mercury-column height. Normal barometric pressure equals 29.92 in. (760 millimeters) of mercury at 32 F. For accuracy the reading must be corrected for temperature, because of thermal expansion of the mercury and the glass or metal tube, altitude above sea level, and instrument calibration. This is important when measuring low absolute pressures with vacuum indicators, Fig. 10, on steam-condenser tests. A mercury gage, Fig. 11, has a center zero for measuring pressures both above and below atmospheric.

A differential U-tube, Fig. 13, and inverted tube, Fig. 14, measure the pressure difference between taps A and B. The inverted tube, usually filled with gas, serves to measure liquid-pressure differentials when open columns would be too high or the liquid could not be exposed to atmosphere. Valve X permits varying the quantity of fluid in the gage.

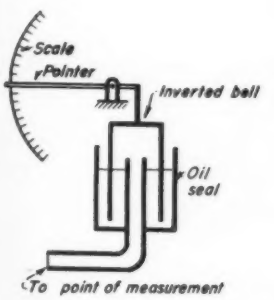
A 2-fluid manometer, Fig. 15, is more sensitive than a simple U-tube for small gas pressures because it indicates measurements over a broader scale for the



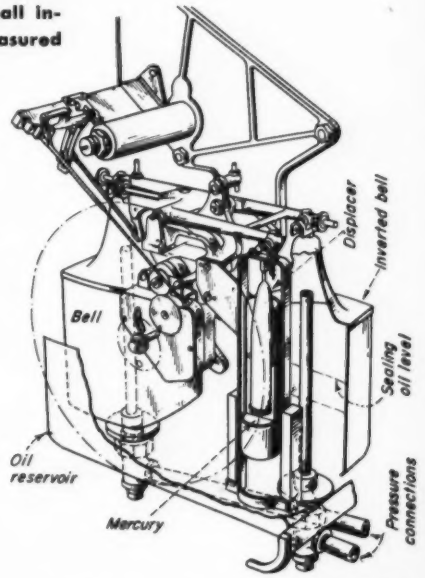
6 The inclined gage filled with a light liquid measures static pressure in air-conditioning or ventilating systems or draft in furnaces



7 The inclined tube magnifies vertical level movement so that small increments of pressure can be measured



8 The single inverted bell measures low pressures if properly sealed with liquid

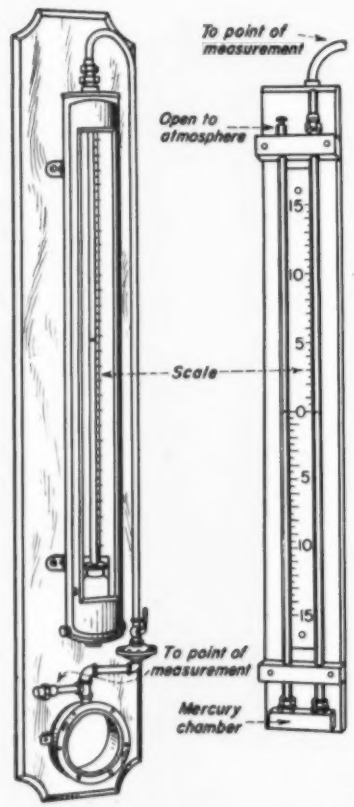


9 A balanced set of inverted metal bells measures differential pressure

same pressure differential. Results are best when one liquid's specific gravity is only slightly greater than that of the other. Fig. 16 shows the difference in mercury elevation when two tubes, one containing water and the other air, are subjected to the same pressure differential.

A liquid-column manometer is subject to an error in reading if internal diameter of tubing is too small because the meniscus is quite pronounced. This is especially true if the areas of the two surfaces in the measurement are widely different. Bore variations also introduce errors. For these reasons, tubing below ¼ in. ID should not be used.

A piston gage, Fig. 17, for pressure ranges from 5 psi up, consists of a rotatable close-fitting piston riding in a vertical cylinder and mounting a weight platform on its upper end. Piston must be rotated when using the gage to eliminate friction errors. At low pressures inertia of the light piston is so small that it is difficult to maintain rotation. On higher pressures piston diameter must be kept small to avoid excessively heavy weights. Device in Fig. 18 avoids the latter difficulty by using a 2-diameter piston.



10 Mercury gage shows condenser pressure in terms of vacuum. 11 Center zero gage measures (positive or negative) pressures

PISTON WIDELY USED

The piston principle is used in: (1) pressure-gage testers (2) engine indicators and (3) transmission of pressure readings. In the tester, Fig. 19, it produces a known pressure for checking bourdon-tube gage accuracy. Here the piston carrying a known weight produces a known pressure in the cylinder communicating with the pressure gage. The screw-operated piston *X* forces liquid into the cylinder to raise the pressure piston. To avoid friction effects the weight table rotates slowly during test.

In an engine indicator, Fig. 20, a spring-loaded piston is acted upon by pressure inside the engine cylinder. The piston moves a pen that writes on a paper attached to a movable drum. Mechanical connection between piston rod and instrument's drum through a reducing motion gives an oscillating movement to the drum as the engine operates. Thus pen-and-drum movement produces a visible record of varying cylinder pressures caused by expansion throughout the engine stroke.

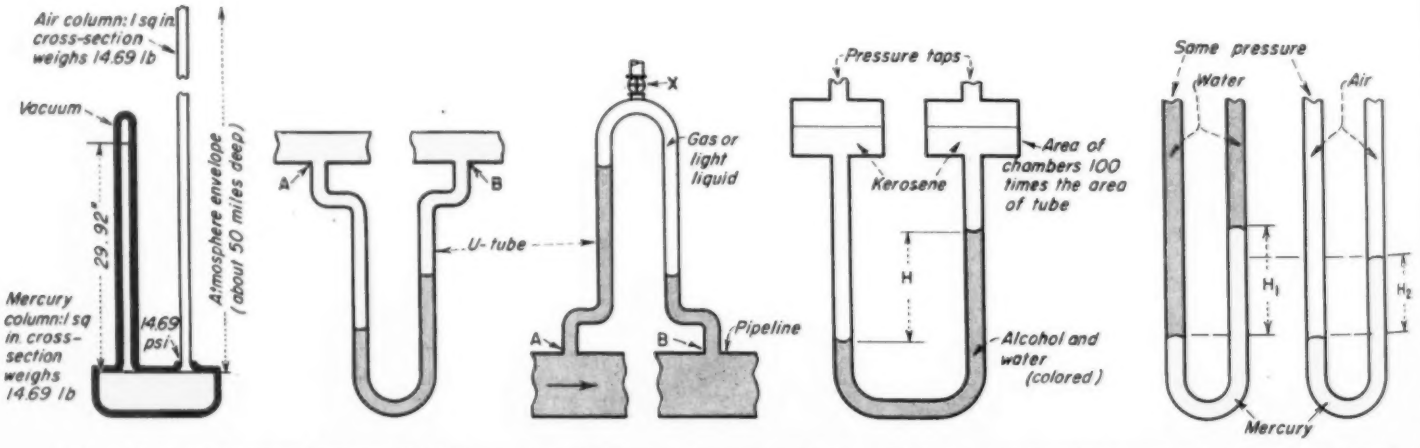
When using this principle to transmit pressure readings the piston is rotated by an electric motor. A pressure change moves the piston to operate a pilot valve that controls the oil flow to a piston in another cylinder, Fig. 21. This cylinder positions a float in a mercury cup carried by the pressure piston. Moving the float varies the load on the pressure piston to return it to its original position. Float height is telemetered to a distant point and recorded as pressure.

In another automatically balanced piston gage, Fig. 22, pressure on the piston is opposed by a scale beam. Its movement closes high or low contacts to operate a reversing motor, which balances the beam by sliding the poise. Pressure-piston instruments can be adjusted to indicate measurements over a narrow range—for instance, on a 750-psi boiler, from 725 to 775 psi.

A bourdon-tube gage, Fig. 23, operates by deflection of an oval tube, closed at one end and bent in the shape of a circle. Tubes are of various metals for different pressures. In measuring the pressure of hot or corrosive fluids a suitable seal must keep the substance out of the tube, Fig. 28.

Tube movement operates a pointer through a toothed sector and pinion. It is customary to select gages that operate near the middle of their scale because continuous operation, near full-scale reading or at over-pressures, may upset the tube so it becomes inaccurate at lower readings. The helical element, Fig. 25, and spiral element, Fig. 24, are similar to the single tube in Fig. 23, except that their greater length gives broader pointer deflection for a given pressure change.

Fig. 26 explains why the tube tends to change its curvature when subjected to internal pressure. When pressure is applied to an elastic oval tube *A*, it tends to become circular, *B*. Hence when the



12 A 1-sq-in. column of mercury 29.9 in. high is balanced by a column of atmosphere having same cross-sectional area. 13 Liquid-filled U-tube measures pressure difference between points *A* and *B*. 14 Gas-filled inverted U-tube measures the pressure drop in a liquid-filled line. 15 Using two fluids of slightly different specific gravity gives a greater level change for a given pressure variation. 16 Action of a 2-fluid tube that uses water and air separately with mercury

cross-section attempts to change from oval to circular, outer circumference of ring increases from C_1 to C_2 and puts the metal under tension. Likewise inner circumference decreases from D_1 to D_2 and puts the metal under compression. This action on the ring is such as to move it toward a straight shape, *E*, and position the pointer.

Bourdon-tube gages are available in these designs: (1) compound pressure and vacuum (2) gage with suppressed zero (3) magnified graduations over part of the scale (4) double-tube gages (5) multiple-tube instruments.

Pulsating pressures, which soon destroy the accuracy of the sector-and-pinion movement by wearing teeth and bearings, can be minimized by throttling the shutoff valve or installing a pressure snubber, Fig. 27. Other designs use (1) moving piston whose inertia prevents rapid pulsation (2) large number of small tortuous passages to smooth out pulsations (3) separating diaphragm and gage-filling liquid that must pass through a felt obstruction.

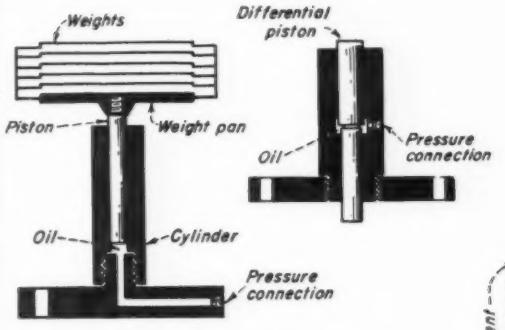
DIAPHRAGM GAGES

Diaphragm gages serve the same purpose as bourdon-tube elements although they are not employed for high pressures. Distortion of the diaphragm, which is clamped inside a housing, moves a pointer or other indicator through linkage connected to the diaphragm center. Corrugating a metal diaphragm gives it about four times as much deflection as a flat one for the same pressure change. In general, diaphragm gages provide larger force than bourdon tubes for actuating, indicating and recording devices, Fig. 29.

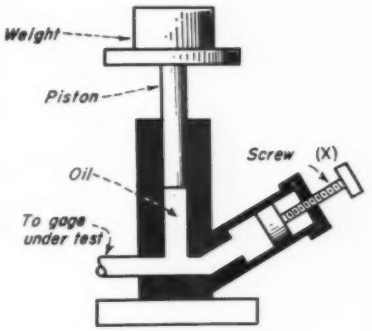
Limp (flexible) diaphragm instruments use soft, elastic material such as specially selected leather, treated cloth or rubber. Diaphragms are spring loaded. The unit in Fig. 30 can be connected to read pressure above or below atmospheric or pressure differential. Diaphragm is carried by the drive linkage and is opposed by a leaf spring. Turning the adjusting screw moves the bellcrank about its pivot and shifts the calibrated spring linkage to adjust instrument pointer to zero. Suitable stops prevent jamming the pointer by overdeflection.

For measuring differential pressure the higher pressure is applied to the chamber containing the spring, and the lower pressure to left side of diaphragm. Connecting the gage across the furnace and the last pass of the boiler makes it an indicating flowmeter for low static pressure.

A metallic bellows, Fig. 31, provides an element sensitive to low pressure,

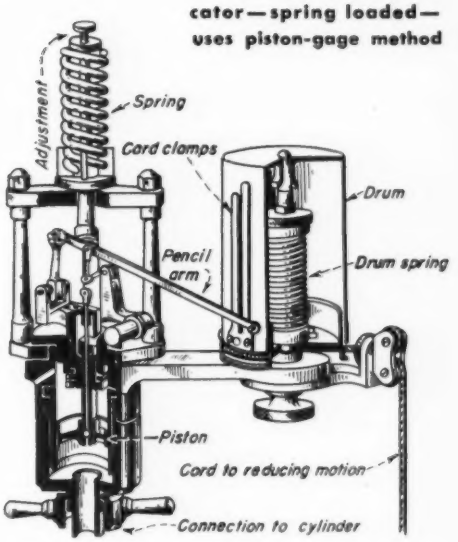


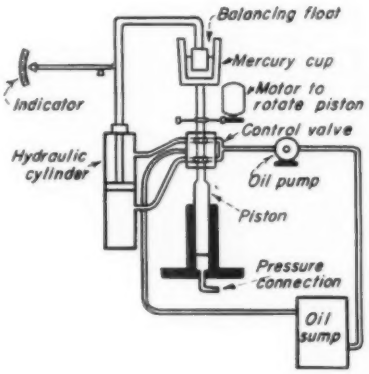
17 Simple piston gage has weights that balance the actuating pressure. **18** When measured pressures are high a differential piston can be used to reduce the size of weights

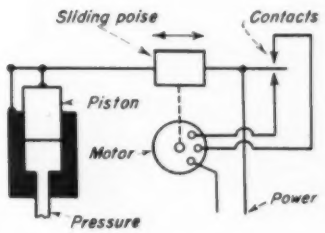


19 Adaptation of piston gage to check conventional bourdon-tube pressure gage

20 *(below)* Engine indicator—spring loaded—uses piston-gage method

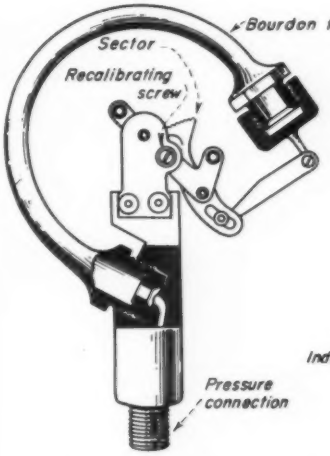




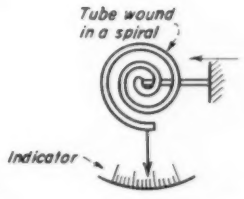


22 *(above)* Piston moves contact arm and motor rebalances poise

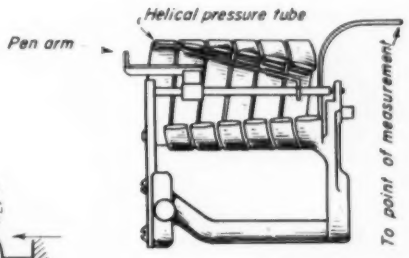
21 *(left)* Piston-gage transmitter with motor-rotated piston weight



23 Conventional half-turn bourdon tube for pressure gage. Tube end moves sector and pinion

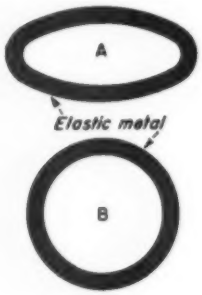


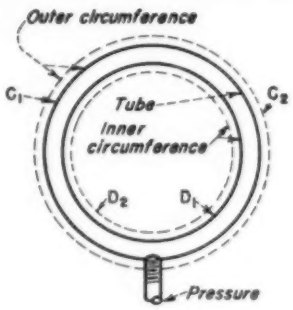
24 Spirally wound bourdon tube produces a greater pointer deflection for a pressure change

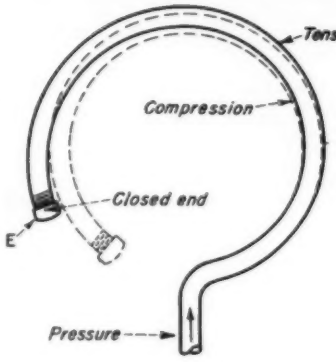


25 Winding the tube in the form of a helix also offers the advantage of greater pen deflection. Instrument design determines which tube shape will give the best results

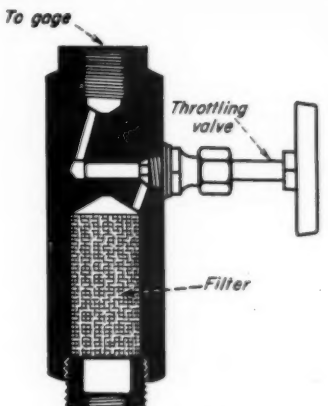
PRESSURE ELEMENTS



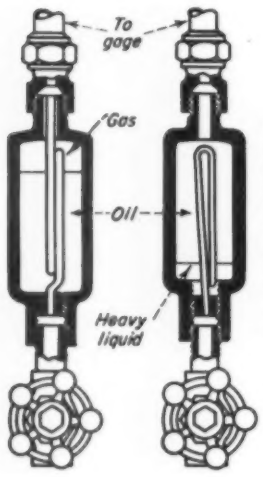




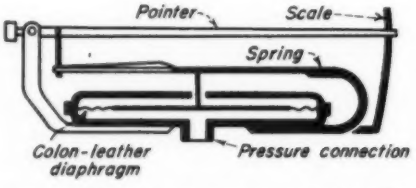
26 An oval-shaped tube *A* tends to assume the shape of a circle *B* when pressure is applied to it internally. If tube is bent in the shape of a hook with one end anchored, pressure moves the free end in a direction to straighten out the hook



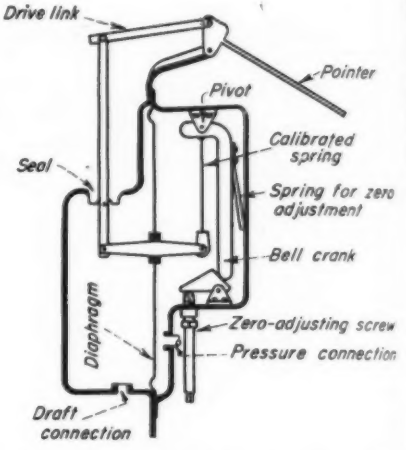
27 Snubbers throttle pulsating pressures and minimize damage to gages



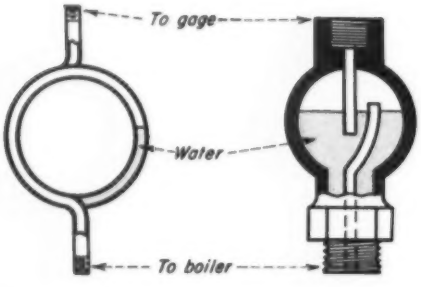
28 *(left and below)* Liquid sealing chambers filled with a suitable fluid keep corrosive or hot substances out of pressure gage. Be careful when mounting to see that they retain the filling agent

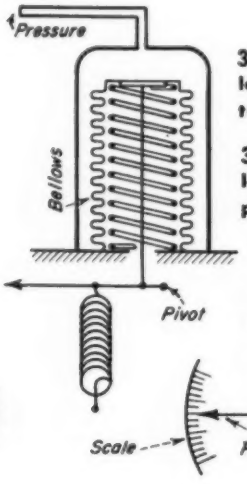


29 The limp diaphragm made of flexible leather or rubber operates a pointer to measure positive or negative pressures



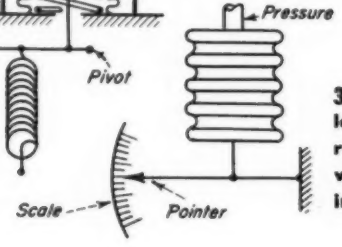
30 Limp diaphragm gage adaptable for measuring positive or negative pressure or pressure differential

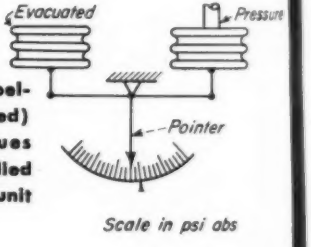




31 *(left)* Spring-loaded bellows serves to measure pressure

32 *(below)* Long bellows may buckle when pressure acts inside it





33 *(right)* Double bellows (one unit evacuated) reads absolute values when pressure is applied inside the remaining unit

able to withstand fairly high pressure, yet powerful enough to operate recording and indicating mechanisms. Bellows are formed from: (1) tubing by rolling, spinning or hydraulic forming (2) corrugated disks soldered or welded together (3) solid rods that are machined to shape. In practice the bellows is spring loaded and deflection characteristics result from those of the spring and bellows. Metals for fabrication are: (1) brass (2) phosphor-bronze (3) beryllium copper (4) copper-nickel alloys (5) mild steel (6) monel.

A bellows that is long in proportion to its diameter tends to buckle when pressure is applied internally, Fig. 32, and a load applied at one end, since under this condition each convolution tends to get longer. Best design applies the pressure externally, Fig. 31, so that each convolution gets shorter and pulls on adjacent ones to keep the bellows straight. The double-bellows unit, Fig. 33, with one side evacuated to as near a perfect vacuum as practicable and the other connected to the pressure to be measured, registers absolute pressure with reasonable accuracy. Atmospheric pressure affects both bellows alike and therefore cancels itself.

A hot-wire pressure gage has an electric-bridge circuit with two resistance elements heated by an electric current. One element is exposed to the atmosphere and the other to the air space being measured. Change in density of the atmosphere surrounding the exploring element changes the heat conductivity and, therefore, the temperature of this element. Thus its resistance changes and upsets the bridge balance.

A piezoelectric gage, which is essentially a laboratory instrument, uses a quartz crystal to measure pressure. Current generated by the action of pressure on the crystal is proportional to the pressure applied across a given area.

Pressure Valves

Here we will consider valves to reduce and relieve pressure, control backpressure, and govern pumps and fans. In general these units are divided into the following three groups: (a) diaphragm-operated valves, Fig. 1 and 2, (b) piston-operated valves, Fig. 3, (c) electrically operated valves, Fig. 4.

The operating motors are opposed by a weight, spring or fluid pressure. Although all these motors can be connected for on-off (fully open, fully closed) operation, the motor of the diaphragm- or piston-operated valve will hold it at any intermediate position between open and closed. However, this is not true of the solenoid-operated unit. If it is open when the coil is energized it must be closed when the coil is de-energized. Only alternative is to have a separate solenoid for each intermediate position, Fig. 5.

COMBINATION UNITS

A diaphragm and piston are often combined in one unit. The valve in Fig. 6 is operated by air pressure from a pneumatic controller acting on a rubber-diaphragm motor (not shown). First downward movement of valve stem opens the pilot valve *A*, which admits pressure through passage *B* to top side of piston. Thus pressure on top of piston balances that on underside of valve disk. Continued downward movement of the valve stem pushes strongback *C* against the piston to move the valve against spring force *D*. Balancing piston eliminates unbalanced forces in single-seat construction and single seat provides tight shutoff on deadend service. In Fig. 7 a piston, controlled by a metal diaphragm, operates the main valve.

Pressure-control valves are classified as (1) pilot-operated and (2) self-operated. In the first, a separate pilot controls admission of outside pressure to the valve motor. In the second, operating pressure usually comes from the fluid being handled and acts directly on the operating motor.

Both of the above classifications are further subdivided into (a) Direct-acting: Unit decreases its opening as operating pressure is increased, Fig. 8, *A*. (b) Reverse-acting: Valve opens wider upon increase of operating pressure, Fig. 8, *B*.

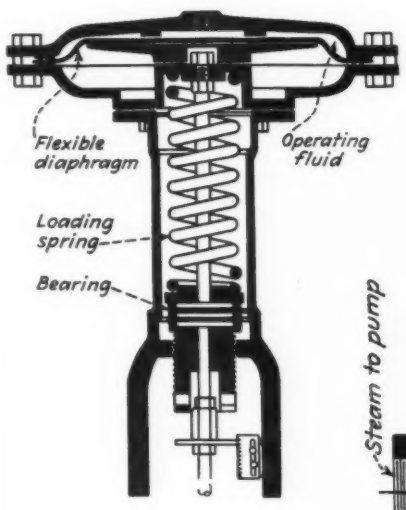
Pilot-controlled valves serve best on complicated systems or where the valve requires more power than is available in a self-operated unit. Here operating power can be taken from the fluid handled or from an outside source, and the primary instrument response can be amplified pneumatically, hydraulically or electrically before application to the main valve motor.

While the self-operated valve is entirely satisfactory for many services it has certain limitations. With single-seated valves the regulated pressure varies slightly with variations in primary pressure but this deviation is minimized in double-seated valves. Also, in diaphragm-operated valves, the amount of travel is proportional to the load change per psi of applied pressure on the diaphragm. Being the flexible member it is made of natural or synthetic rubber with fabric insert, treated leather or metal. Metal diaphragms have great strength and are able to operate in contact with steam (pilot lines should drain condensate away from diaphragm) but lack sufficient flexibility to allow much valve movement unless the diameter is large.

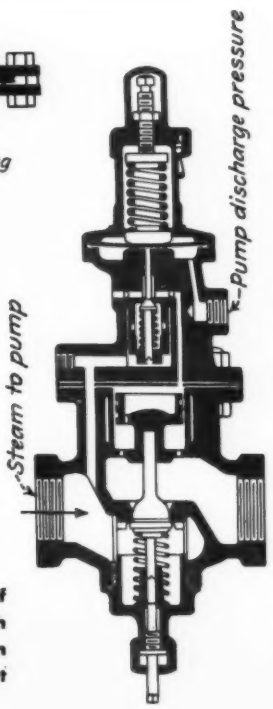
VALVE OPERATION

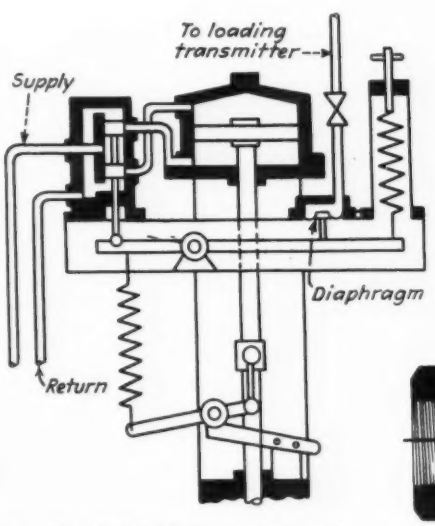
Assume three valves operating at (1) 100 psi with a 20-sq-in. diaphragm (2) 30 psi with a 63-sq-in. diaphragm and (3) 10 psi with a 132-sq-in. diaphragm, Fig. 8, *C*, *D* and *E*. Suppose we increase the pressure 1 psi on the 100-psi valve. Acting on 20 sq in. this produces a 20-lb increase in force opposing the springs. Since spring deflection is proportional to the applied load the valve moves in proportion to the 20-lb increase. In like manner, 1-psi increase on the 30-psi valve is 63 lb, and on the 10-psi unit, 132-lb increase in force on the springs, which produces a corresponding proportional deflection and valve travel.

Spring load shown at each valve is the force required to compress the coils until

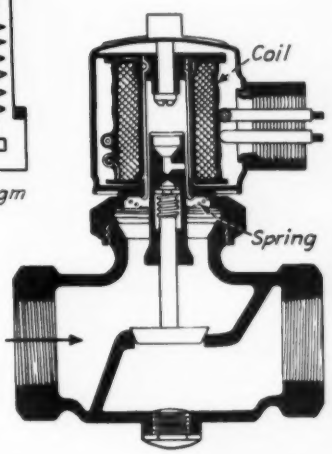


1 Flexible diaphragm is made of natural or synthetic rubber with fabric inserts. The construction permits wide valve-plug movement

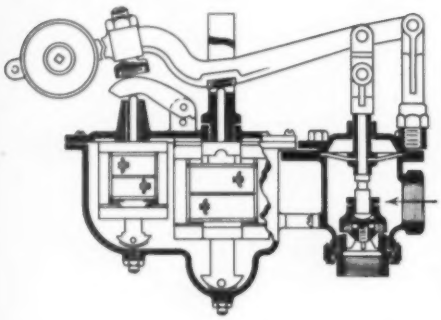




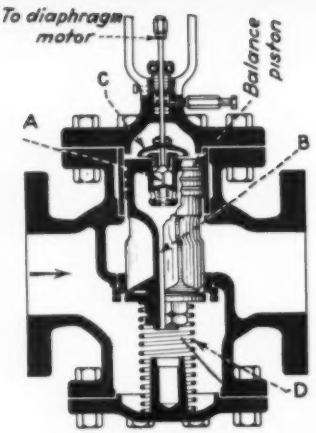
2 Metal diaphragm, acted on by pump pressure, controls admission of fluid to top of valve piston.
3 Piston motor piped to receive operating fluid from an outside source. Control is by the diaphragm



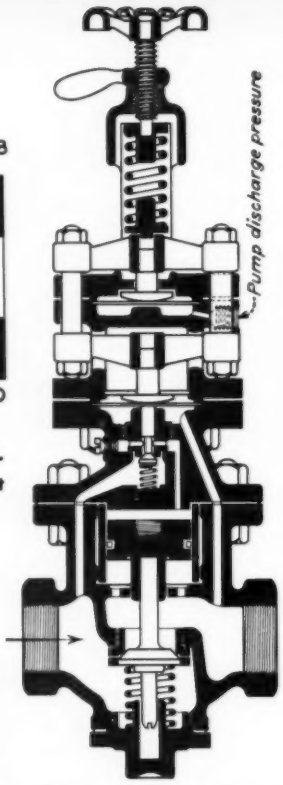
4 Single solenoid valves have only two positions, open and closed. Because of this they cannot be used for throttling purposes



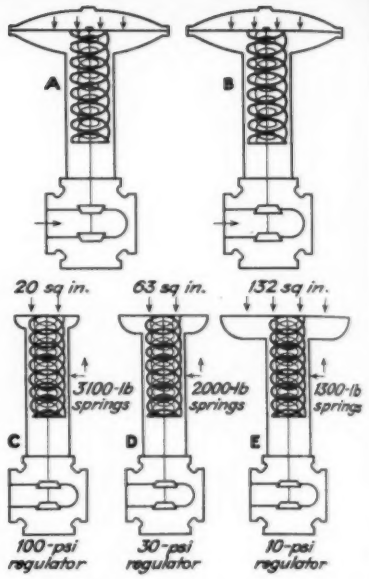
5 Two coils give three positions



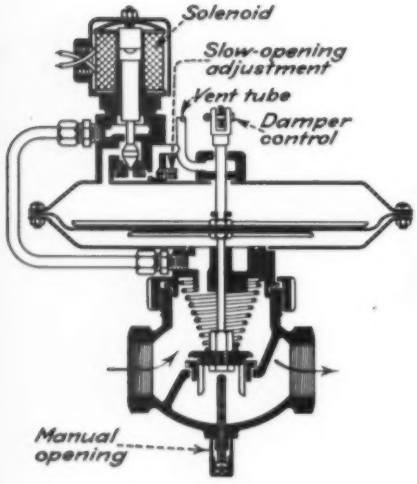
6 Balancing pressure admitted on initial stem movement



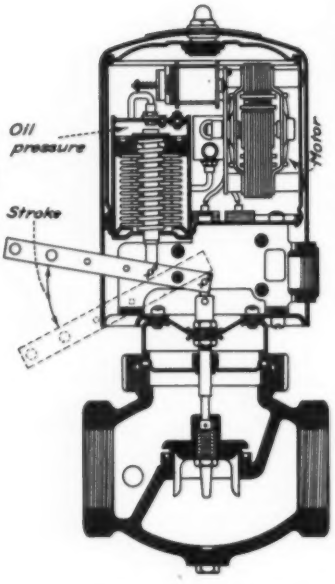
7 Diaphragm controls piston that operates the main valve



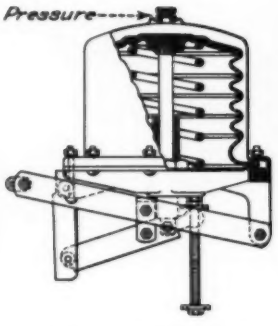
8 Diaphragm travel is proportional to the change in applied pressure



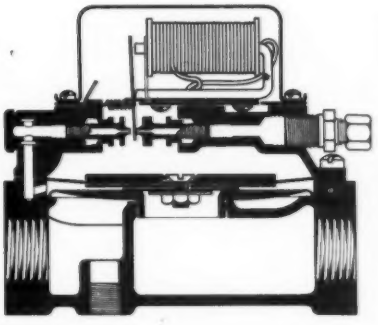
13 Solenoid pilot admits pressure to or bleeds it from diaphragm upper chamber. Line pressure opens the valve and the spring closes it



14 Motor-driven pump sends oil to operating bellows



15 Air-pressure operated bellows moves dampers



16 Electric relay receives its current from thermocouple in the pilot flame

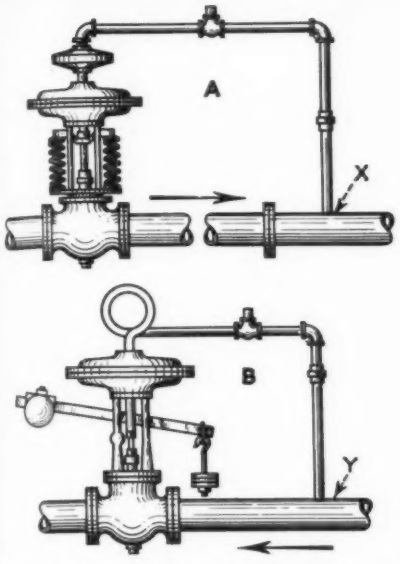
they are "dead" or touching one another. Therefore the 1-psi increase in pressure produces a deflection of 20/3100 or 1/155, 1/32 and 1/10 of the total spring compressibility in each respective valve. If the total compressibility of each spring is 3 in. the change of 1 psi in operating pressure moves the valves 0.019, 0.094 and 0.30 in. respectively. Thus the 10-psi valve moves 15 times farther than the 100-psi one. Considered from another angle, pressure on the 100-psi diaphragm must increase 15 psi before it moves as far as the 10-psi unit moved on the 1-psi change.

Going to higher pressures with self-operated valves even greater pressure variation can be expected before the unit moves any appreciable distance. Higher pressure means lower sensitivity. In general this type is satisfactory for service below 25 psi and for handling fairly constant volumes up to 150 psi. Fig. 9, *A* shows a self-operated direct-acting valve maintaining reduced pressure in line *X*, and Fig. 9, *B* a reverse-acting unit maintaining backpressure in line *Y*.

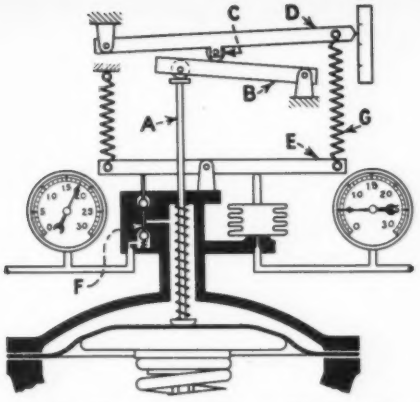
On oversized or unbalanced valves or those inclined to stick, a valve positioner, Fig. 10, assures precise movement for even the slightest change in controlled pressure. Here stem *A*, adjustable on its upper end, is held against valve diaphragm by a spring. One end of lever *B* is fulcrumed and the other rests on stem *A*. The rider *C* is set in position for full valve travel and connects lever *B* with *D*, which is fulcrumed at one end. A spring connects levers *D* and *E*.

Control lever *E* acts like a balance and operates reverse-acting pilot valve *F*. Spring force on left end of lever *E* is of permanent magnitude. Two variable forces act on the right end; the magnitudes change inversely to each other, but the sum always equals spring force on left end. Variable force of the right-hand spring is governed by valve-stem position and that of the bellows by applied operating pressure. Pilot-valve pressure and that applied to the diaphragm comes from an outside source. Operation is such that bellows movement upsets balance arm to operate pilot valve until main valve moves and changes spring force *G* enough to rebalance arm *E*. Another improvement for complicated control problems is the double-diaphragm top, Fig. 11. With this arrangement pressure or temperature control applies operating fluid to the upper diaphragm and a process time controller connects to the auxiliary chamber.

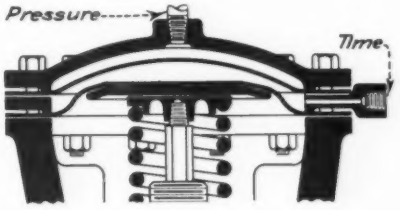
The pilot-controlled regulator consists of a valve whose operating pressure is controlled by either an external or an



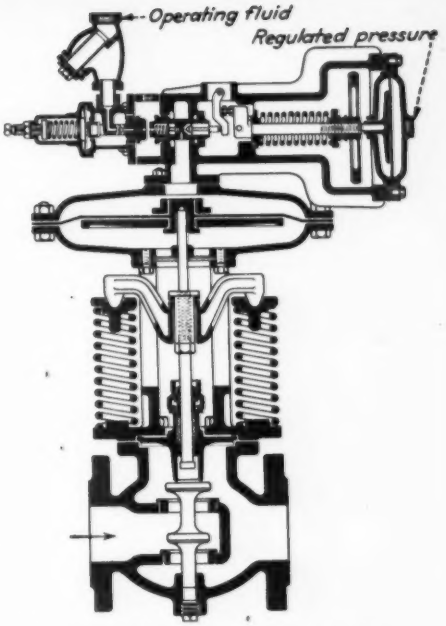
9 Self-operated valve holds reduced pressure at *A* and backpressure at *B*



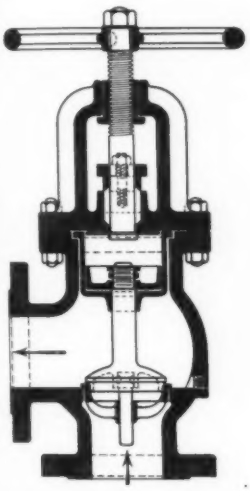
10 Positioner assures positive setting



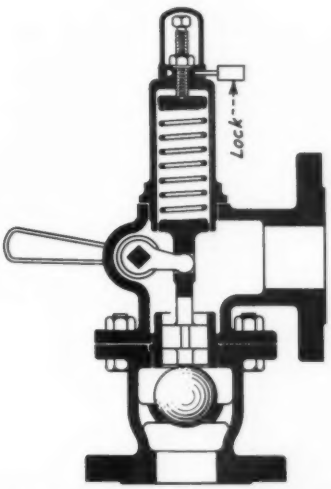
11 Second diaphragm serves time element



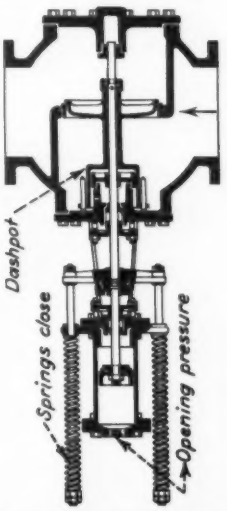
12 Main valve carries external pilot and small operating-pressure reducer



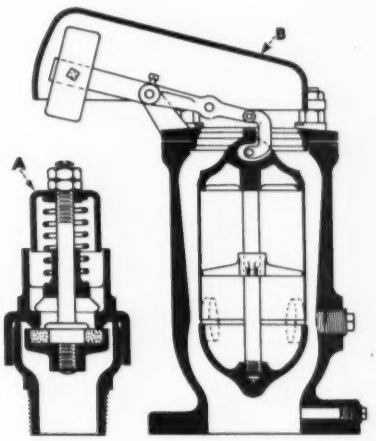
17 Once opened, valve operates as a non-return device



18 Valve provides a quick shutoff for a line failure



19 When open, valve disk is free to slide on its spindle



20 Valve *A* protects vessels against high vacuum and *B* breaks the vacuum in pipelines used for gravity flow

internal pilot valve, Fig. 12 and 2 respectively. Pressure being controlled acts on the pilot-valve diaphragm and a slight pressure variation is ample to actuate the pilot valve and permit the operating fluid to exert full force on the main diaphragm or piston.

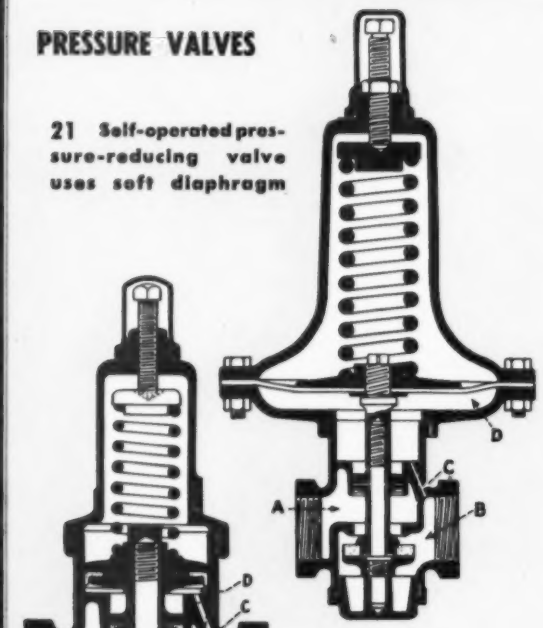
Unit in Fig. 7, fitted with monel diaphragms, is used as a pump governor. In operation the handwheel is adjusted to compress the spring and move external yoke downward until pilot valve opens. This admits steam from main-valve inlet to top of piston, opening the main valve and admitting steam to the pump. Reduced steam pressure acts on lower diaphragm, and pump discharge pressure is piped back to upper-diaphragm chamber. These pressures react on the diaphragms to control pilot valve, which in turn positions main valve to maintain a constant pump-discharge pressure.

Solenoid-operated valve, Fig. 4, is constructed to be open when coil is energized. The solenoid pilot, Fig. 13, allows pressures above and below diaphragm to equalize when deenergized. When plunger and pilot stem move up the upper diaphragm chamber is isolated from the lower, and pressure in the former bleeds out an adjustable vent. Line pressure then opens main valve and air damper. Valve always closes quickly but opening time can be changed by turning the bleed-vent adjusting screw. While air dampers are often operated by the fuel-valve motor a separate bellows device, Fig. 15, can be incorporated in a more complex system. Compact design permits mounting it inside duct work.

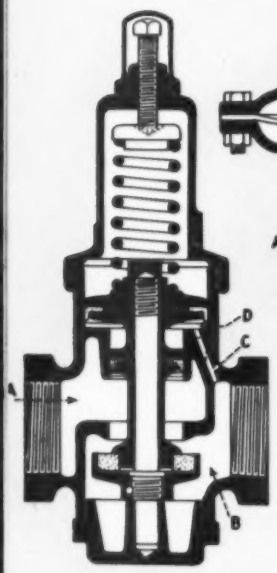
The hydraulic-motor valve, Fig. 14, is designed to control gas feed and furnace dampers. A motor-driven pump supplies oil under pressure to open the valve. Oil pressure is maintained by a magnetically actuated release as long as valve mechanism remains energized. Should control fail or call for a fuel shutoff, magnetic release would vent the oil pressure and a spring closes the valve. The unit in Fig. 16 also controls gas feed to a furnace, the electric relay receiving its operating current from a thermocouple in the pilot-burner flame. Failure of this flame automatically shuts off gas flow.

A device of considerable importance to boiler operation is the nonreturn stop-and-check valve, Fig. 17. Once opened by manually screwing up the handwheel, the valve operates automatically as a non-return device to cut off reverse steam flow if a boiler tube ruptures. Some valves have a second seat to prevent steam flow should a header burst.

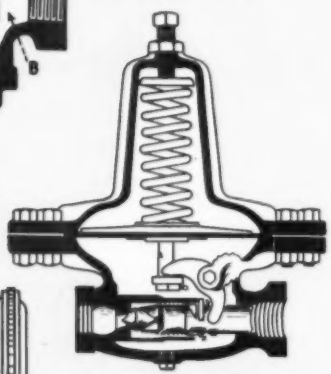
Unit in Fig. 18 fills the requirement for services that must be shut off quickly

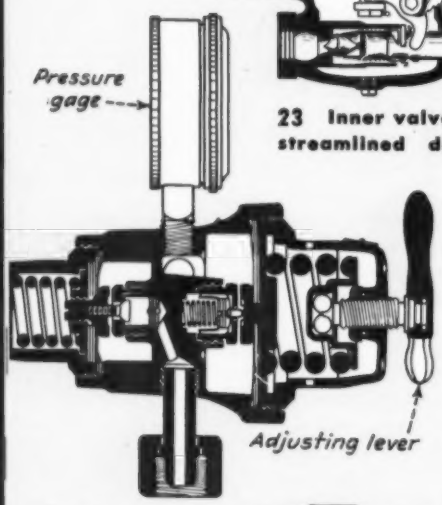


21 Self-operated pressure-reducing valve uses soft diaphragm



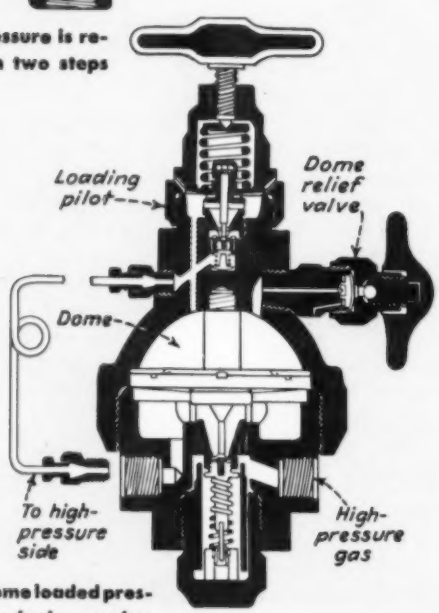
22 Piston operates this reducing valve





23 Inner valve has streamlined design

24 Pressure is reduced in two steps



25 Dome loaded pressure-reducing valve

in line breakage or vessel rupture. When large vessels are not strengthened against external pressure the vacuum breaker, Fig. 20, *A*, will open if internal pressure drops below the safe point. The air-inlet valve, Fig. 20, *B*, protects large pipelines against vacuum when used on gravity systems.

To close itself, one turbine-bleeder nonreturn valve, Fig. 19, uses an oil cylinder and springs in addition to reverse flow. Hydraulic pressure from turbine-oiling system forces piston to top of its stroke and compresses the springs. Then valve spindle is free to slide back and forth along the valve stem—opening to permit steam flow from turbine and closing on reverse flow. Should emergency governor act, a trigger that trips the main throttle valve releases oil pressure in the cylinder and spring compression pulls the bleeder valve closed. A fiber ring, on top of piston, seats against upper cylinder head to prevent oil leakage when piston is at top of its stroke. Spring compression should not prevent this seating. A closed dashpot in valve body cushions valve spindle movement.

SELF-OPERATED UNITS

Self-operated pressure-reducing valves all operate as do the diaphragm valve, Fig. 21, and the piston valve, Fig. 22. Spring force and incoming pressure at *A* tend to hold main valve open until discharge *B* fills with fluid at the required reduced pressure. Flow upward through passage *C* to chamber *D* forces the valve toward closed position until its opening just maintains a reduced pressure corresponding to spring force. Fig. 23 uses a streamlined inner valve.

Unit in Fig. 24 reduces the pressure in two steps with two independent diaphragms. Full primary pressure enters first stage and is reduced to an intermediate pressure set by the manufacturer. Second stage, manually set by adjusting lever, reduces intermediate pressure to the required value.

In pressure-loaded regulators fluid under pressure serves in place of a spring to load the diaphragm. Unit in Fig. 25 is employed for primary pressures up to 4000 psi and delivers pressures up to 1000 psi. Turning the pilot tension screw clockwise into the housing loads the diaphragm to the correct pressure as shown by an attached pressure gage. Tension screw is then released. To reduce diaphragm-loading and delivery pressure, open dome relief valve until the desired value is reached.

Unit in Fig. 26 has its dome charged with air or other gas. Pressure then passes through restricting orifice in separating plate to the operating diaphragm. Dome pressure is always slightly higher than that at valve outlet to overcome the force of the two springs acting to close the valve. If diaphragm fails, pressures on both sides of it equalize and the springs, together with incoming pressure, force the valve to its seat. Unit is separate from diaphragm rod to eliminate binding and stem friction. Tight sleeve around operating stem eliminates need of packing. Contours of upper and lower separating plates fit that of the diaphragm and prevent damage to it by high one-sided pressure.

Air dome may be charged periodically from an ordinary hand air pump, a compressed-air line, high-pressure CO_2, or air bottles. With gas-loaded domes ambient temperature variations affect loading pressure and therefore that of the regulated fluid. The automatic dome-loader controller, Fig. 27, takes care of ambient temperature variations. It operates from a pressure supply up to 3000 psi and maintains correct pressure inside the dome. When temperature affects the dome air, the changed pressure reacts on the diaphragm, Fig. 27, to admit more air to the dome or bleed some out of the relief valve. Normally both valves remain closed.

Valve in Fig. 28 consists of a flexible tube surrounding two metal sleeves containing rectangular ports. Tube expands to open and is closed by hydraulic pressure applied between it and outer casing. Valve serves for fluids containing sand, cuttings or other fine solids.

ALTITUDE VALVES

Altitude valves are pressure-regulating units that maintain a set level (pressure) and prevent overflowing of tanks. For the unit in Fig. 29, a separate pilot assembly can be located wherever convenient. Height of liquid (pressure) to maintain is set by adjusting pilot-valve spring. The valve is double-acting and suited for single-pipe systems. (Liquid is pumped to the tank and then backflows through the valve to the distribution system when inlet pressure falls below tank pressure.) For a double-pipe system check valve *A* is removed and the openings plugged.

Valve, which is normally closed, opens by pressure under the disk. When the desired tank head is reached pressure on diaphragm of the pilot valve opens it, and admits pressure to diaphragm of 3-way valve. The latter closes its drain port and admits pressure to the top of main-valve piston *B*, which then closes the main valve.

When supply pressure falls below tank static head, pressure on pilot-valve diaphragm bleeds off through check valve *A*. Spring closes pilot valve, which cuts off pressure to 3-way valve diaphragm.

Diaphragm pressure then bleeds off through adjustable orifice; 3-way valve closes its supply port and relieves the pressure on main-valve piston. Static pressure from tank flows up port *C* under the piston and opens the valve so that liquid can flow back into the supply line.

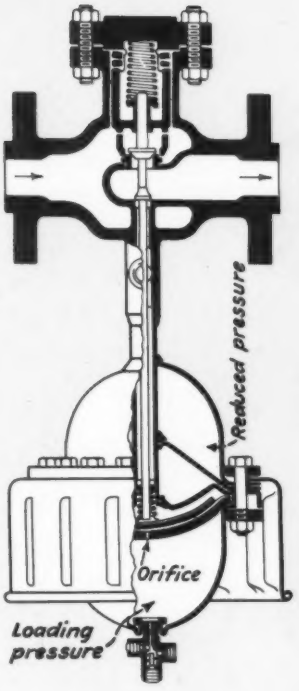
The valve in Fig. 30 is suitable for either single- or double-pipe systems. Fluid from the pump enters at the left. If there is no pressure at the outlet side or in chamber *A*, pilot valve *B* is open, main valve is lifted from its seat by inlet pressure and flow established. Liquid from the inlet passes through adjustable cock *C* to diaphragm chamber *A*. Cock *C* is adjusted so its port area is less than that of pilot valve *B*. Final reduced pressure is transmitted through pipe *D* to underside of control diaphragm *E*, which is opposed by adjustable spring *F*. As the desired reduced pressure reaches the value for which spring *F* is set, pilot valve *B* starts to close and its port area becomes less than that of cock *C*. Therefore inlet pressure builds up in chamber *A* and closes the valve. Regulation is maintained by the varying ratio of pilot-seat area to cock area. On back flow through the valve, pressure on tank side is highest and pressure in chamber *G* holds the valve open.

INNER-VALVE STYLES

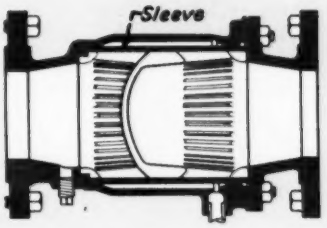
Regulating valves are made single and double seat or balanced—two ports and an upper and lower disk of about the same area. This feature makes the valve easy to operate because flow enters between the two disks so that pressure thrust is practically nil. Inner valve is designed for quick or gradual opening (V-port or parabolic). Valves that open gradually find greatest application where close throttling is desired or the rate of flow varies greatly.

If the balanced valve uses metal-to-metal seats, it has one drawback caused by the difference in expansion between the valve plugs and body. If the seats are ground at one temperature the valve may leak at some other. For deadend service, especially where the temperature may vary, it is best to use a single-seat valve. For further information on limp-diaphragm valve characteristics see POWER: "Valve Installation," p 76, Dec 1942, and "Regulating Valves," p 73, April 1945.

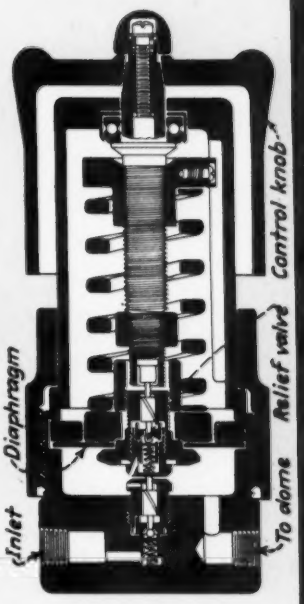
Safety and relief valves and rupture disks provide an emergency outlet for confined energy that is approaching the danger point. When specifying these devices state the pressure at which they are to lift and the temperature of the fluid handled. Temperature determines what kind of metal the device is made

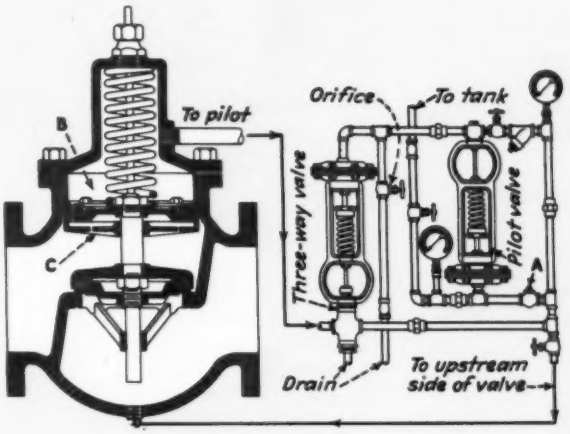


26 Flexible diaphragm unit has a pressure-tight sleeve to eliminate valve-stem packing. **27** *(right)* Automatic regulator corrects dome-loading pressure for ambient temperature variations affecting dome pressure



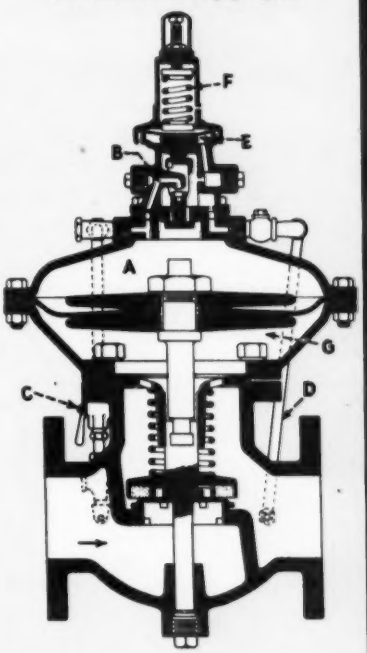
28 Hydraulic fluid forces flexible sleeve against ports to shut off flow in the pipeline

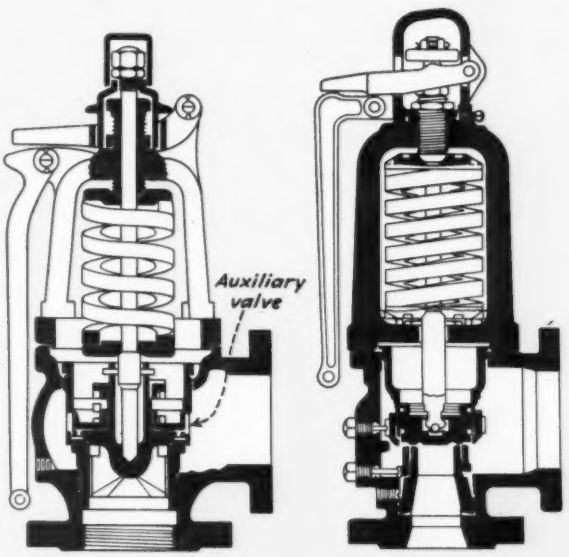




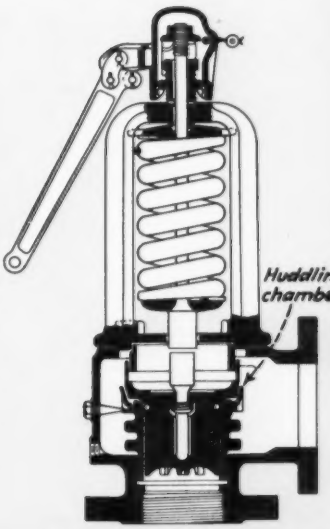
29 Complete altitude valve control maintains the correct level (pressure) and prevents overflow of standpipes and reservoirs. Works on one- or two-pipe system

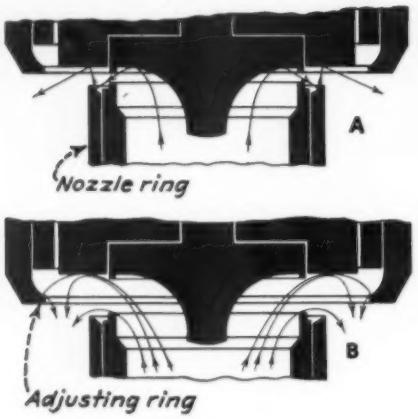
30 *(below)* This altitude valve is a self-contained unit having pilot control mounted inside the body. For one- or two-pipe jobs



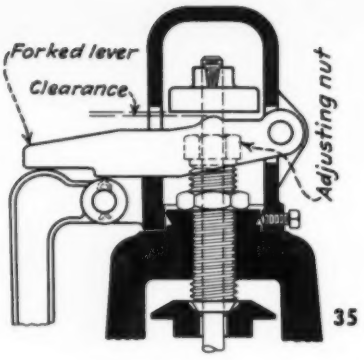


31 *(left)* Auxiliary valve helps snap main disk open to produce a positive discharge. **32** *(center)* After initial lift reaction of steam impingement pops the valve wide open. **33** *(right)* Huddling ring restricts initial discharge and helps pressure act on disk

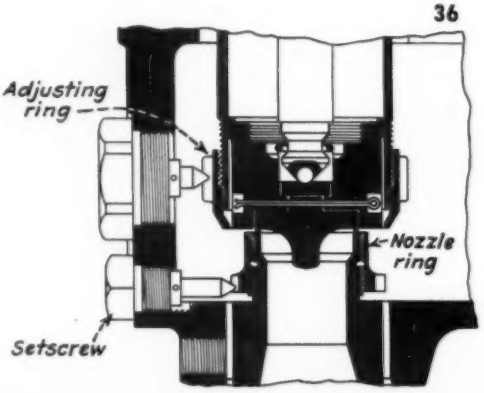




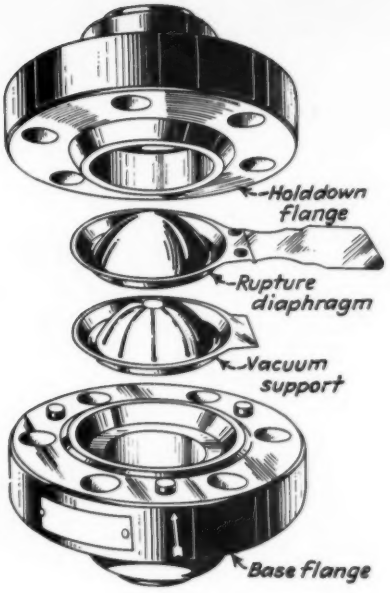
34 Steam pressure overcomes spring, lifts valve disk, *A*. Then jet strikes nozzle ring, raises valve all the way, *B*



35 Adjust for correct pressure only when boiler is popping or pressure is considerably below the setting



36 Set blowdown range by positioning the adjusting ring. Make increment settings with the nozzle ring



37 Rupture disks are carefully designed weak spots which let go whenever pressure exceeds or falls below the safe value

from and affects the specific volume of the gas and hence the valve capacity in lb per hr. Valves rated on saturated steam have lower capacity on superheated steam in lb per hr.

Only spring-loaded safety valves are permitted by boiler codes. They should pop clean without simmering and close without chatter or simmer within the required blowdown limits. To secure a clean pop and proper blowdown, the valve in Fig. 31 employs an auxiliary valve, the one in Fig. 32 the reaction energy in the steam velocity, and the one in Fig. 33 a huddling chamber. Fig. 32 has a flat seat as compared with a 45-deg seat in the others.

Basic principle of blowdown adjustment centers on the kinetic energy of steam flow. When the force of the steam pressure acting under the disk overcomes the spring, valve lifts slightly. The small jet of escaping steam is deflected from the nozzle ring, Fig. 34, *A*, and assists in raising the valve farther. Downward deflection of steam from the adjusting ring, Fig. 34, *B*, then assists in holding the valve open until blowdown point is reached.

To change the popping pressure loosen the adjusting-sleeve locknut, Fig. 35. Raise the boiler pressure until valve pops, then turn the adjusting sleeve down to raise the popping pressure, or up to lower it. To prevent turning the disk on its seat always make adjustments while valve is popping or when boiler pressure is at least 15 psi below valve reseating pressure.

Adjust blowdown range by raising or lowering the adjusting ring. In valves with an upper ring, lowering it increases blowdown; with only a nozzle ring, blowdown is increased by raising it. In valve having two rings, upper one provides major adjustment and lower one micrometer adjustments.

Consider the unit in Fig. 36. To change adjusting-ring setting remove the upper set screw. Insert a screwdriver and engage it in the ring notches. Pushing the notches to the right raises the ring and shortens the blowdown. If adjusting ring is raised too high in attempting to shorten blowdown, it does not control the valve, and further raising has no effect. Opening lift may be very low (prolonged simmer) and closing may be indistinct and dragged out. Never move the ring more than ten notches without retesting the valve.

SAFETY-HEAD DIAPHRAGMS

Practical Minimum Bursting Pressure

Diaphragm material	Diameter, in. ½	¾	1	1½	2	3	4	6	8	10	12
Aluminum or aluminum, lead lined*	150	150	110	100	60	40	35	25	20	19	18
Carbon steel*	1750	1300	800	500	400	275	200	150	110	90	60
Copper or copper, lead dipped*	600	475	400	300	190	130	120	90	80	70	50
Gold or gold veneer	600	475	400	300	190	130	120	90	Electroplated only		
Monel metal*	800	750	600	450	400	300	275	220	200	150	125
Nickel	1200	1100	850	600	375	250	150	140	250	225	200
Platinum	200	180	135	100	75	80	70	60	Made specially		
Silver	200	180	135	100	75	80	70	60	Electroplated only		
Stainless steel*	1500	1200	800	600	450	400	300	275	200	180	150

Minimum bursting pressures in some large sizes (for example, nickel—6 in. minimum, 140 psi; 8 in. minimum, 250 psi) are higher than minimum pressures for small diameters of same metal. This apparent discrepancy is explained by the fact that in these particular cases very thin metal is not obtainable in widths required for larger diaphragms.

*Standard diaphragm materials

Do not change nozzle-ring position until all possible positions of the main ring have been tried. Never move the former more than five notches from its original position, and not more than two without retesting the valve. Lowering the ring decreases the power of the low-lift pop action and raising it increases power of the low-lift pop action.

BLOWDOWN ADJUSTMENT

When adjusting for blowdown near the valve's minimum, raising the ring slightly corrects for simmering without sensibly affecting blowdown. On the other hand, slightly lowering the ring lessens blowdown slightly in a valve operating properly otherwise. When adjusting a valve always keep a record of the number of notches each ring is moved. This assures returning to the original settings in case of error and prevents getting the valve badly out of adjustment. Worn or damaged seats cause trouble. Slight wear is corrected by lapping but it must be done carefully to keep the seats true. On valves with flat level seats lap the seat and disk on a cast-iron lapping block, which is tested frequently on a good surface plate. Use a fine texture grinding compound and apply it sparingly. Let the weight of the block do the work; do not press down. Never lap the disk against its seat because this procedure may scratch the surfaces.

Rupture disks (also known as safety heads), Fig. 37, are carefully designed "weak spots" that let go when the pressure or vacuum inside a closed vessel exceeds a certain safe maximum value. They should be considered strictly as an emergency relief — a safety measure of last resort, which blows out in time to save the vessel.

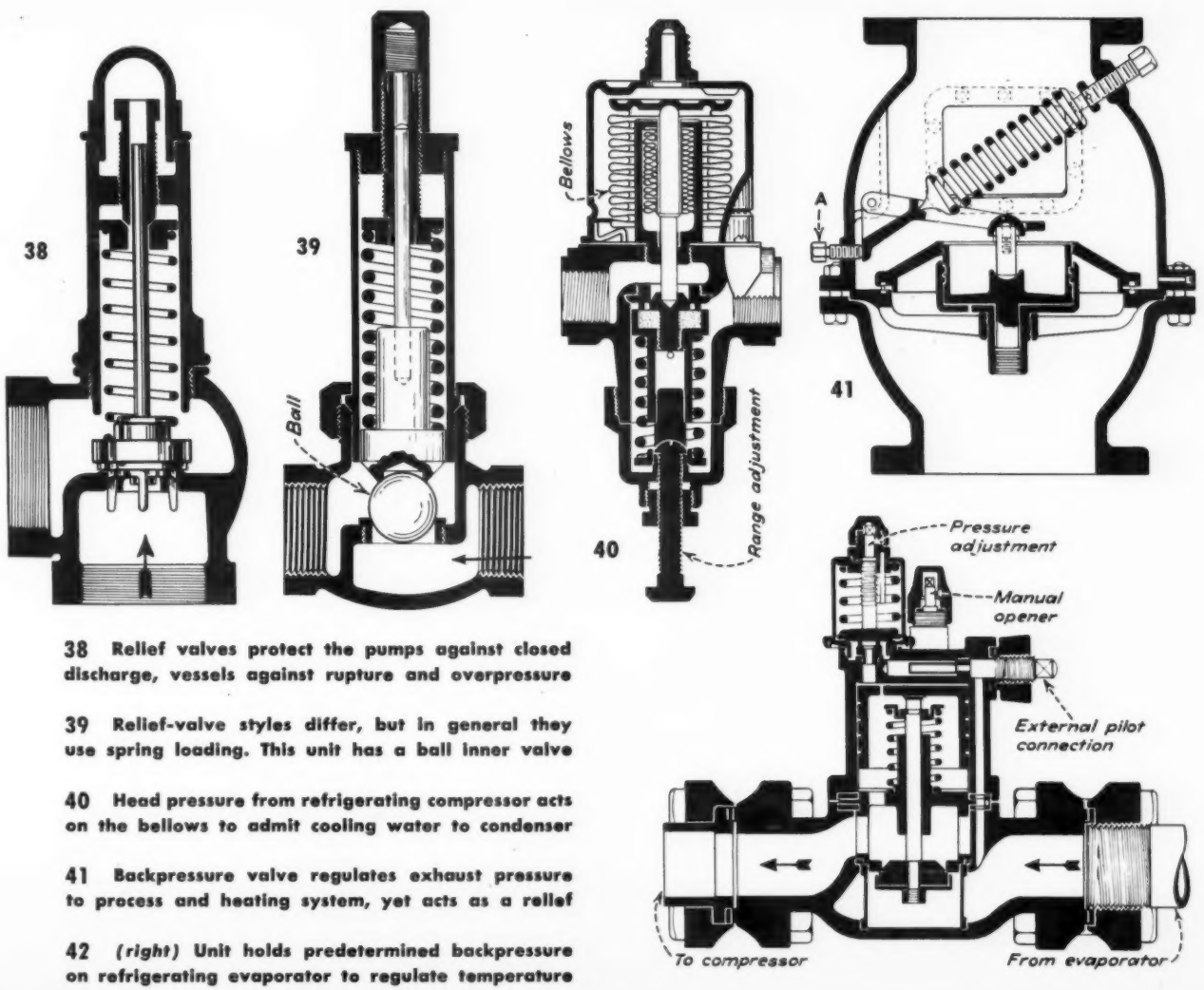
Recommended practice is to equip the vessel with a safety valve set slightly above the working pressure and large enough to hold the internal pressure from exceeding a certain value. Then back up the safety valve with a rupture disk designed to burst before tank does.

Disks are made for a wide range in pressures (see table) to rupture within about 5% of rated operating pressure. They are made of aluminum, copper, steel, stainless steel, monel, bronze, Admiralty metal, nickel, Everdur, Herculoy, silver, gold or platinum. In addition the disk may be given a protective coating of lead, latex, Bakelite or Neoprene.

Relief valves protect positive displacement pumps against a closed discharge, tanks against rupture, and steam-using equipment against over pressure. Styles differ but in general they use spring loading. Unit in Fig. 38 has an angle body and flat disk whereas the one in Fig. 39 uses a ball inner valve.

BACKPRESSURE UNITS

Another design, Fig. 41, serves to hold a backpressure on machine exhaust and yet acts as a relief for pressures above its setting. These units can also be used as atmospheric valves on condensing turbines and engines. In operation the spring and lever mechanism maintains constant relation between spring force and backpressure regardless of valve position (opening). To change from backpressure or vacuum operation to free exhaust, turn jackscrew *A* all the way in to hold valve off its seat. Valve in Fig. 42 maintains a predetermined backpressure on refrigeration evaporators regardless of fluctuations in compressor suction pressure. In Fig. 40, refrigerating-compressor head pressure acts on the bellows to open the water supply to the condenser or cylinder jackets.



38 Relief valves protect the pumps against closed discharge, vessels against rupture and overpressure

39 Relief-valve styles differ, but in general they use spring loading. This unit has a ball inner valve

40 Head pressure from refrigerating compressor acts on the bellows to admit cooling water to condenser

41 Backpressure valve regulates exhaust pressure to process and heating system, yet acts as a relief

42 *(right)* Unit holds predetermined backpressure on refrigerating evaporator to regulate temperature

Temperature Elements

Unlike pressure, temperature or *thermal potential* cannot be measured directly but must be inferred from its effect on a substance whose characteristics are understood. This inference is based on one of the following: expansion of a liquid, gas or solid; vapor tension of a liquid; change of electrical resistance; electrical potential produced by dissimilar metals in contact; intensity of total radiation or of a particular band of wave lengths of radiation given off by a hot substance; and change in state of a liquid, gas or solid.

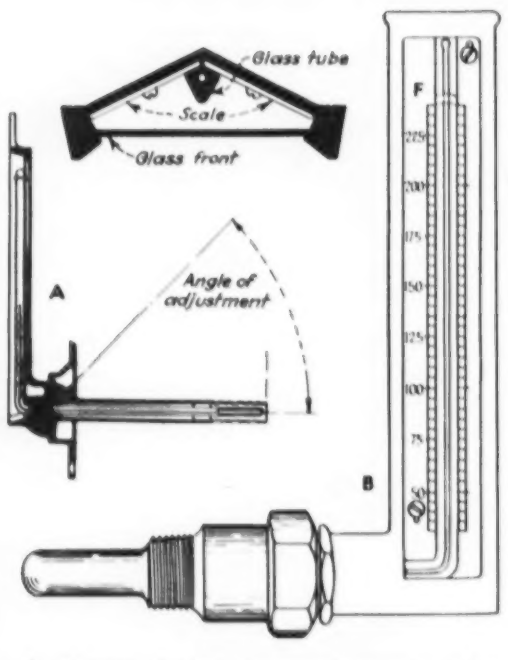
The liquid-expansion-in-glass thermometer is one of the most commonly used devices for measuring temperature in industrial processes and general utility services. Shapes vary since the tube may be (1) bent at an angle with the scale to meet installation requirements, Fig. 1, *B*, or (2) adjustable within a narrow range, Fig. 1, *A*. The first type uses a sealed-guard bulb to measure the temperature of fluids under pressure, and the second, an open-guard bulb to measure air temperatures.

A pencil thermometer for laboratory and plant tests carries scale markings directly on its glass tube, Fig. 2. For pipes or vessels, a separate well is screwed into the container, filled with a heat-transfer liquid, and the thermometer inserted, Fig. 2. A guard screws into the well to protect the thermometer against breakage.

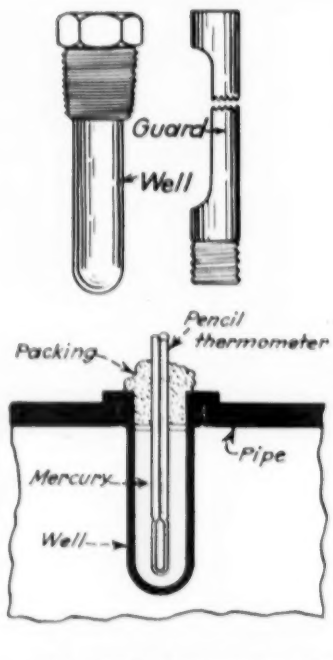
Fig. 3 illustrates a thermometer that indicates maximum and minimum air temperature. Bulb *A* and part of *B* are filled with a liquid such as alcohol. Connecting capillary, which is calibrated in degrees, contains a quantity of mercury and two metal floats. Although carried along with the mercury each float has enough friction against the tube walls to hold it in place as the mercury recedes. Shape of floats permits alcohol to pass freely. A small magnet is used to reset the floats.

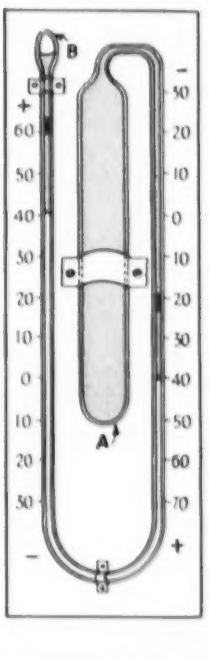
In air-conditioning and cooling-tower work it becomes necessary to find two temperatures of the air—*dry* and *wet bulb*. Dry-bulb temperature is shown by a regular thermometer but to read wet-bulb requires that the bulb be covered with a wet cloth, Fig. 4, while the air whose temperature is being measured is passed rapidly over the bulb. In Fig. 4,*A* dry- and wet-bulb thermometers mount side by side and a water container keeps the bulb sleeve constantly wet. Fig. 4,*B* shows the water-pan and cloth arrangement for the bulb of a remote-reading thermometer.

Glass thermometers with mercury serve for temperatures of -38 to 750 F; quartz tubes containing mercury, and filled with nitrogen under pressure, are good for 950 to 1000 F. Toluol, alcohol and pentane serve as the liquids for temperatures of -143, -171 and -328 F respectively. Glass thermometers are calibrated for either total or partial im-



1 **Shapes of glass thermometers vary; tube can be bent at any angle to meet installation requirements. Complete unit can be mounted in a joint to permit movement in narrow range**





2 **Pencil thermometer** *(left)* **can be attached to the outside of vessels or inserted in wells.**
3 *(right)* **Maximum and minimum temperature registered by mercury moving two metal floats**

mersion; if total-immersion units are not completely immersed they read low for temperatures above the surroundings, and vice versa. For accurate results thermometer indication must be corrected by the amount A for stem temperature.

$$Kn\,(T-t) = A$$

Where: Constant K = 0.00009 for F and 0.00016 for C readings; n = number of degree divisions thermometer fluid emerges; T = bulb temperature; t = stem temperature.

A pressure-measuring device connected to a closed system and filled with an expansible medium can be calibrated to read the temperature at the system's exposed sensitive surface. The dial or pressure thermometer consists of a bourdon spring or bellows connected through a capillary tube to a hollow metal bulb to form a pressure-tight system containing the thermometric fluid, Fig. 5. Internal pressure changes with a change in temperature at the bulb and causes the bourdon spring or bellows to expand or contract. Motion of the bourdon-tube tip moves the pointer to indicate the temperature on a dial.

KINDS OF THERMOMETERS

Pressure-actuated thermometers are divided into four classes.

Class 1 uses a liquid-filled system whose operation is based on volumetric expansion of a liquid (other than mercury) caused by a temperature change. The dial is evenly graduated. Present temperature limit is 750 F.

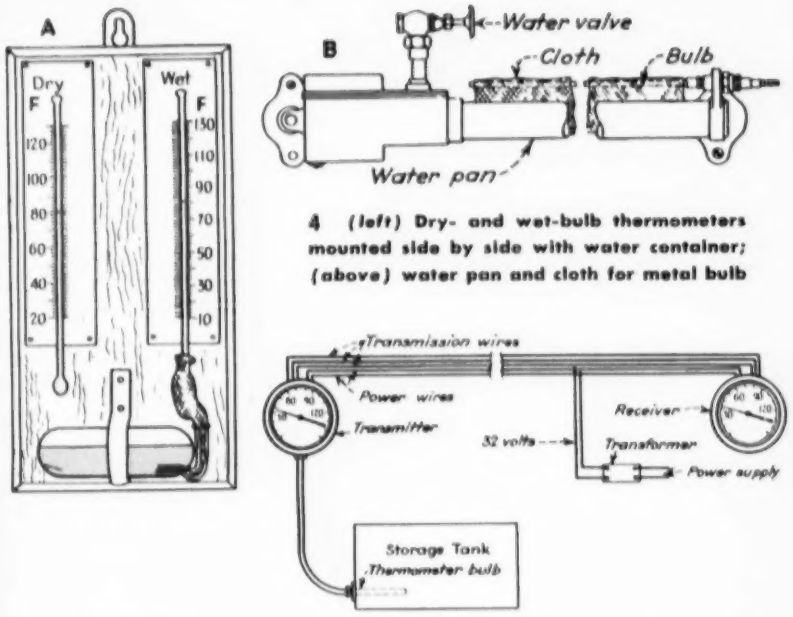
Class 2 uses the vapor-tension system where temperature variation changes the vapor pressure of a volatile liquid such as alcohol, butane, propane, ethyl ether, sulphur dioxide, aniline, ethyl or methyl chloride, toluol and hexane. Dial or chart scale has uneven divisions that become larger up the scale. Present temperature limit is 750 F.

Class 3 is the gas-filled system (usually nitrogen) in which an inert gas expands with an increase of temperature. Limit is 1000 F.

Class 4 is a special division of Class 1, definitely specifying mercury. Temperature limit is 1200 F.

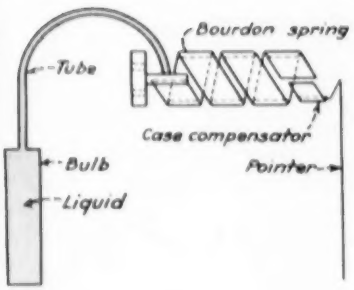
In general capillary tubing for these instruments should not be longer than 200 ft because time lag between bulb and instrument may cause difficulties especially when used with a controller.

Liquid-filled thermometers (Classes 1 and 4) are highly evacuated and filled solid with a liquid under initial pressure, Fig. 5. Since the mercury-filled instrument combines all the advantages of the devices in the other three classes and is typical of Class 1 it is described first. The bulb, capillary tube and actuating device are made of steel or steel

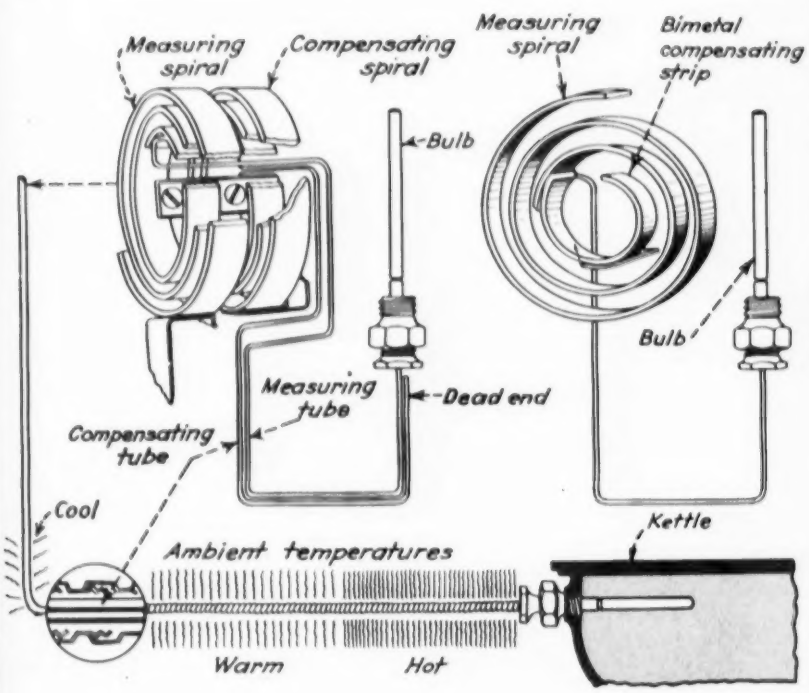


4 (left) Dry- and wet-bulb thermometers mounted side by side with water container; (above) water pan and cloth for metal bulb

6 (above) Mercury thermometer has enough power to drive remote indicators



5 (left) In liquid-filled thermometers the bulb, tube and bourdon spring are completely filled under high pressure



7 Ambient-temperature changes along capillary tube introduce errors which must be compensated for in some manner or the instrument will be inaccurate

alloy, which will not amalgamate with mercury. Joints are welded to provide a pressure-tight system of great strength.

Good practice calls for internal working pressures as high as 2500 psi at the temperature-range maximum. This high pressure permits using a stiff bourdon tube and since pressure change in a mercury system is much greater than in other liquid-filled units this device can drive additional indicating instruments, Fig. 6. Scale graduations are uniform over its entire range.

Temperature changes along the capillary tube, Fig. 7, introduce errors that must be compensated for. Since this tube is filled with mercury it may be considered as a second bulb, its effect on pointer deflection depending on the ratio of the mercury volumes in capillary and bulb. Using extremely fine-bore tubing minimizes the error.

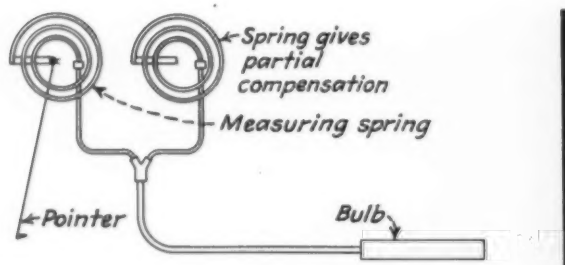
Since line error is directly proportional to capillary length (a function of volume) and there is a limit to how small the bore can be made, additional compensation must be incorporated in the instrument for long capillary tubes. Simplest method of partial compensation connects one or more extra bourdon springs to the mercury system, Fig. 8, in parallel with the actuating spring, but keeps them free of the pointer linkage. One spring absorbs one half the mercury expansion thus cutting in half line-error effect on the main spring. Line error reduces in exact ratio to number of extra springs added but bulb volume must be increased in direct proportion to the number of springs added.

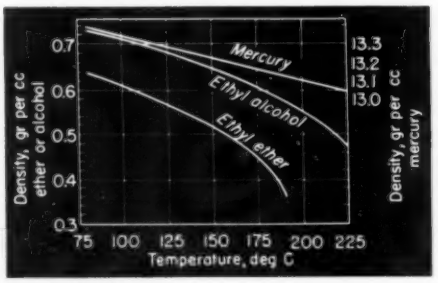
Full compensation is obtained by using an extra bourdon spring and capillary tube, but no bulb, Fig. 7. Capillary is the same length as operating tube and encased in the same protecting armor. The two bourdon springs connect to the pointer through differential linkage so that compensating-spring movement subtracts from operating-spring movement, Fig. 9, *A*, to position pointer according to temperature change at bulb.

One form of capillary compensation uses a relatively large-bore capillary tube, which contains a full-length invar wire, Fig. 9, *B*. The wire's coefficient of expansion is so related to that of the tube and mercury that any expansion or contraction of the tube and mercury is accurately counteracted at the point of fluctuation. Units of this type in which the compensation does not place an extra bourdon spring inside the instrument case must be compensated for temperature variations inside the case that affect the bourdon spring. The compensator usually consists of a bimetallic strip, Fig. 7 and 9, *B*, connected between the actuating spring and pointer in such a way that it neutralizes any movement of the actuating spring caused by temperature changes in the case.

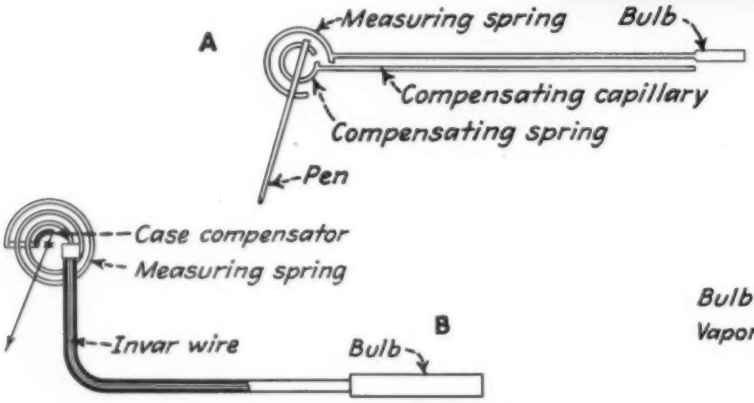
Mercury-filled pressure thermometers must be corrected for bulb elevation only when this elevation exceeds a certain height. Because mercury exerts a hydrostatic pressure of 6 psi per foot height this pressure adds up materially when instrument and bulb are located at widely separated elevations. On the other hand mercury-filled units are assembled and operate under high initial pressures, 200 psi minimum and 2500 maximum, so small differences of several feet in elevation do not require correction. A mercury-filled bulb averages the temperatures to which it is exposed. This eliminates the effects of temperature stratification or zones. Bulbs can be 10 to 15 ft long for flue-gas measurement. These units respond quickly to bulb temperature changes (small thermometric lag) and their great power makes them well suited to carry the added load of extra indicators. Unit in Fig. 6 operates a Selsyn motor to transmit reading to a distant point.

Thermometers filled with other liquids are affected by external conditions much as mercury units are, and also show other peculiarities. These liquids have coefficients of expansion three to eight times that of mercury and also

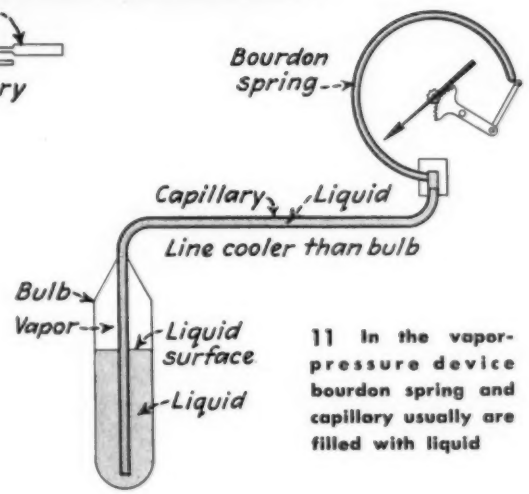




10 **Density-temperature relations for mercury, ethyl ether and ethyl alcohol**



8 *(top, left)* **Second bourdon spring (not connected to pointer) gives partial compensation for capillary temperature changes**
9 *(above)* **A and B compensate for case and tube temperature**



11 **In the vapor-pressure device bourdon spring and capillary usually are filled with liquid**

higher factors of compressibility. For instance ether is compressed 33 times and alcohol 22 times more than mercury when under 150-psi pressure. Fig. 10 compares density-temperature characteristics of mercury, alcohol and ether. As with mercury, other liquid fillings have an initial internal pressure of several hundred psi and from a practical standpoint no correction for bulb elevation is necessary.

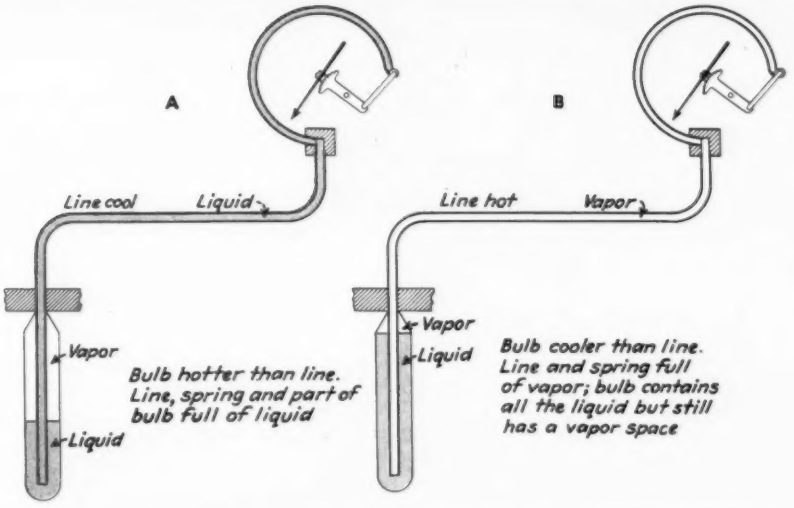
Vapor-pressure thermometers derive their name from being actuated by the vapor pressure of a volatile liquid in the pressure-tight system. If the system is evacuated and then partly filled with a volatile liquid, Fig. 11, a definite relation exists between the liquid temperature and the pressure of its vapor. To assure a true vapor pressure at all times the system is so filled that the bulb always contains a free liquid surface and vapor space. Capillary lengths may be up to 200 ft; no particular limitations apply to bore size except that if it is too small fluid friction causes some lag in the instrument response.

Because power for operation depends on the pressure increase for a given increase in bulb temperature the vapor-pressure thermometer is most powerful and accurate in the upper portion of its range. Therefore it is important that these units be selected so the working point falls in the upper half of the scale and the range is as small as possible. Scale graduations become progressively wider from bottom to top of the dial.

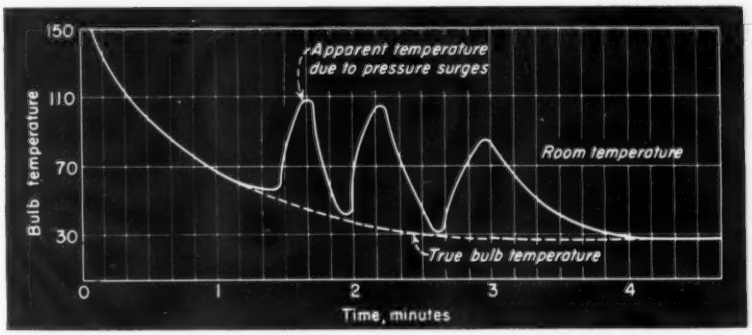
TEMPERATURE EFFECTS

As long as the bulb is the hottest part of the system, line and bourdon spring are filled with liquid, Fig. 12, *A*. If line and spring become hotter than the bulb, they will be filled with vapor and all the liquid will be in the bulb, Fig. 12, *B*. In either case, the free liquid surface is in the bulb and correct bulb temperature will be indicated as soon as conditions reach equilibrium.

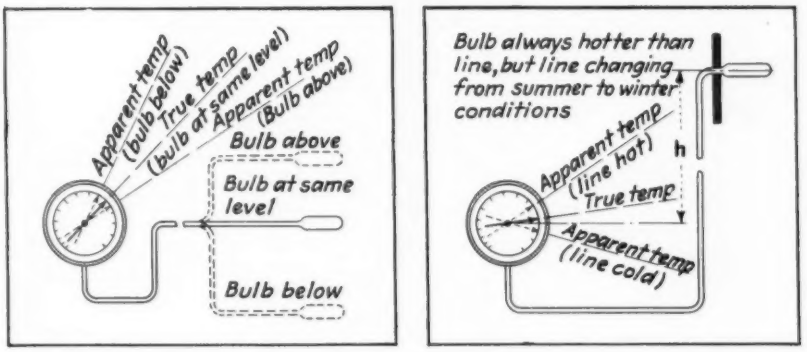
When the line and spring first become hotter than the bulb the liquid momentarily becomes superheated and unstable although under the same pressure as that in the bulb. Vapor bubbles soon form that break the liquid column in the line, progressive flashing continues and the pointer will not indicate true temperature until all the liquid has been vaporized or forced into the bulb and cooled to bulb temperature. During this process pressure surges build up in the line, as in Fig. 13. When line and spring cool down action of pointer is again erratic until all vapor in the line condenses. If these reversals are apt to occur in service specify that the instrument be provided with necessary compensation.



12 As long as bulb remains hottest, the rest of the system remains filled with liquid. When capillary tube is the hottest it fills with vapor



13 Erratic action of a vapor-pressure thermometer during the period the capillary-tube temperature increases above that of the sensitive bulb

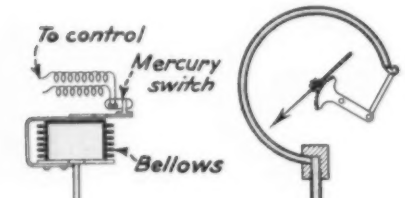

Apparent temp (bulb below)
True temp (bulb at same level)
Apparent temp (Bulb above)
Bulb above
Bulb at same level
Bulb below
Bulb always hotter than line, but line changing from summer to winter conditions
Apparent temp (line hot)
h
True temp
Apparent temp (line cold)

14 and 15 Positive and negative bulb elevations affect vapor-pressure thermometer accuracy unless capillary tube always remains vapor filled

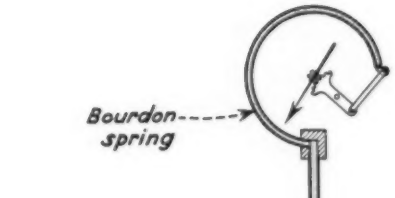
This is a must for a bulb installed with either a positive or negative elevation in relation to the indicator.

Vapor-pressure thermometers must be corrected for either positive or negative bulb elevations unless line and spring always remain filled with vapor. When bulb is above instrument, pointer is set back; likewise, with the bulb below, pointer is set ahead so as not to indicate the hydrostatic head, Fig. 14. Distant-reading instruments using an elevated bulb are subject to slight error resulting from temperature changes along the line. Hydrostatic head depends on liquid density but density changes with temperature, Fig. 10. Therefore pointer adjustment for hydrostatic head is correct for only one line temperature, Fig. 15, but the error can be reduced by correcting for bulb elevation at mean line temperature, using a filling liquid of low coefficient of expansion and selecting as stiff a bourdon spring as possible.

A vapor-pressure system will operate one or more responsive elements from the same bulb without using special line compensation or bulb size. For instance one bulb can operate a bourdon-spring indicator and a bellows-operated switch



16 Vapor-pressure unit is powerful enough to operate one or more elements



17 Combination vapor-pressure and liquid system uses a bellows inside bulb

or other controller, Fig. 16. These thermometers do not indicate the hottest temperature to which the bulb is exposed. Temperature at the free liquid surface in the bulb determines the vapor pressure and thus the temperature registered by the pointer, which will be a value between that of the hottest and coldest part of the bulb. Vapor-pressure systems have small inherent thermometric lag—that is, give quick response.

A combination vapor-tension and liquid-filled system, Fig. 17, has the spring, capillary tube and a bellows completely filled with liquid. Bellows provides a seal between capillary and bulb; the latter contains a quantity of volatile liquid whose vapor pressure acts on the bellows to position instrument pointer. Practically, the device is self-compensating for line error because any temperature change along the tubing expands or contracts the liquid, which does nothing more than reposition the bellows. This has no effect on bulb vapor pressure because it depends on the temperature and not on the volume of the bulb. This unit substitutes ideally for a vapor-pressure instrument where line temperatures are apt to vary above and below bulb temperature.

Gas-actuated thermometers are filled with inert gas, usually nitrogen. Operation is in accordance with gas laws: If gas volume is constant, pressure will increase if the temperature of all or any part of the gas is increased. If all the gas were contained in the bulb or if the bulb, line and spring were heated to the same temperature, pressure rise would be directly proportional to the absolute pressure, as in Fig. 18, *A*. Usually only the bulb is heated; therefore some gas must expand into the line and spring making the final pressure slightly less because of their volume, Fig. 18, *B*.

Just as in a liquid-filled thermometer, the capillary and bourdon spring introduce an error from temperature effects along the line. Gas-filled thermometers are not subject to bulb-elevation errors and are free from bulb and line temperature reversals. They are accurate (Hydrogen-gas unit is accepted as a primary standard in thermometry for temperature within its scope.) but lag in responding to temperature changes.

Because of larger-diameter bulbs—to reduce line error—compressibility of the gas and slower heat-absorption rate, gas thermometers respond more slowly than mercury or vapor-pressure devices. Order of quick response is vapor-pressure, liquid- and gas-filled systems. Where sockets or wells are required their heat-transfer characteristics have a lot to do with the instrument response. Over-all thermometric lag (speed of response) in pressure thermometers is influenced by the kind of filling fluid, size and shape of bulb, length of capillary and size of its bore and by the fluid surrounding the bulb. Lag is greater if bulb is in air, gas or superheated steam than if it is in a liquid or saturated vapor. Agitating the surrounding liquid further reduces lag.

Best location for a bulb in a pipeline is at a bend, Fig. 19, *A* and *B*. This permits using a long bulb and assures flow over its entire surface. If the pipe or vessel is insulated use a socket with extension neck so that lagging can be brought up close and over the extension if necessary, Fig. 19, *C* and *D*. For platen presses drill the bulb holes for a slide fit, Fig. 19, *E*. Because gas temperatures in chimneys, ovens, driers and dry-houses are more variable and difficult to measure accurately than liquid temperatures a long bulb is best to obtain the average temperature. If space is limited use a coil unit and support it as in Fig. 19, *G*. Rotating drying rolls and retorts need special bulb fittings where the bulb enters roll shaft, Fig. 19, *H*.

Bellows have their field of usefulness, mostly for controlling temperature in refrigeration, water heating, air conditioning and process work. The bellows itself may contain the filling fluid; or a system consisting of bellows, capillary tube and bulb similar to those for pressure thermometers may be used. Service requirements determine whether the devices are liquid- or gas-filled, or vapor-pressure. For low-temperature work vapor-pressure units require highly volatile liquids to produce power enough to operate switches and valves. Since these units are frequently exposed to room temperature the amount of liquid added is carefully computed to flatten the vapor-pressure curve at temperatures above the working range. Thus the liquid is entirely evaporated when heated to slightly above the working point and damaging over-pressure is prevented.

PRESSURE LIMIT

Units can be designed to function up to a certain temperature and exhibit no further pressure increase above this point. The bellows in Fig. 20, *B* operates a control switch and can be adapted as a room thermostat or, fitted with bulb and capillary, for process control. The thermostatic switch, Fig. 20, *A* starts and stops small refrigerating plants. The room thermostat, Fig. 21, is a bellows or disk-operated valve used in pneumatically controlled air-conditioning systems. Volatile liquid in this device has a boiling point of 50 F and at 70 F develops about 6 psi, the pressure varying with temperature. Expansion and contraction of the disk under this pressure change operates the supply and exhaust valves and controls compressed-air flow to operate valve and damper motors. Air wastage is a minimum because supply and exhaust valves never open at the same time.

With the system at equilibrium both valves are closed and controlled valves or dampers properly positioned. A temperature rise causes the disk to expand and force supply valve off its seat. Air then enters exhaust-valve chamber and

flows to controlled-valve motor. When air pressure in exhaust-valve chamber acting on exhaust-valve diaphragm balances the bellows pressure, exhaust-valve-body assembly moves to the left and supply valve closes. When room temperature falls, bellows contracts and pressure in exhaust-valve chamber, acting on its diaphragm, moves exhaust-valve body to the left; spring opens exhaust valve until bellows and air pressure again balance. Thus just enough air is bled to reposition the controlled valve or damper in conformity with the room temperature as felt by the bellows.

The bimetallic temperature-indicating and controlling device operates on the differential expansion of two different strips of metal brazed, welded or riveted solidly together. One metal (invar or other nickel-iron alloy)has a low coefficient of linear expansion, and the other (brass or steel alloy) has a high one. (Brass expands 20 times as much as invar per unit of temperature rise.) Thus if a strip of this bimetal is anchored at one end temperature changes make one metal expand more than the other. Since they are fastened together the strip bends and movement of free end can close electric contacts or operate light dampers.

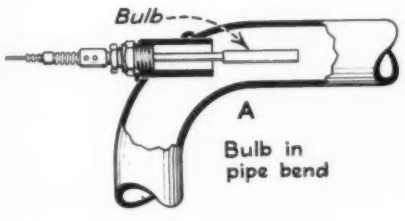
Increasing the strip length gives greater free-end movement for the same temperature change and increasing the bimetal thickness increases the force developed by the strip. However, this additional force is obtained at a sacrifice in instrument response because a longer time is required to bring the thicker metal up to the surrounding temperature. To take advantage of a long strip's greater deflection and yet keep the device within a reasonable size the bimetal is coiled in a spiral, Fig. 22, or bent in another shape. Fortunately the metals in the bimetallic strip have about the same modulus of elasticity.

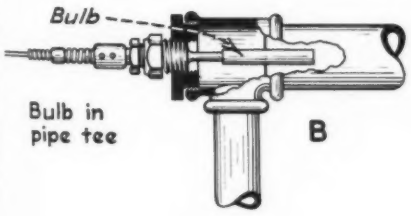
Devices of this kind are not so accurate as pressure thermometers because of hysteresis (lag in movement on temperature reversals) and serve mostly for temperature measurement or control at atmospheric pressure up to 600 F. Fig. 23 illustrates the schematic arrangement of a typical bimetal thermostat. When bimetallic strip bends to close the control circuit a permanent magnet holds the contacts closed until temperature rise causes this strip to exert sufficient force to overcome magnetic pull and open the circuit. Adding this magnetic load to the strip would permit room temperature to overshoot before the strip could exert enough force to open its contact, so a small anticipating coil (resistance heater) is connected into the circuit and placed near the strip. This slight additional heat affects the strip just enough to make up for the magnetic pull. Heater in Fig. 23 has its own parallel circuit but another common method puts it in series with the load.

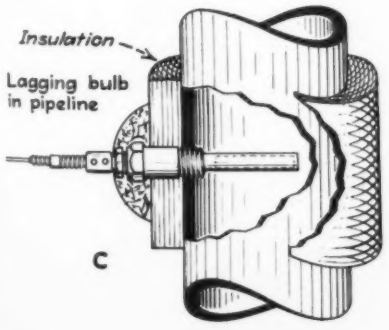
Device in Fig. 24 consists of two bimetallic spirals mounted inside glass bulb *A* and serves as a flame-failure relay on furnaces. Radiant energy is picked up by concave reflector *B* and focused on small bimetal coil *C*, which causes it to close contacts *D* and *E*. If flame fails, bimetallic element cools and opens its contacts. A compensating bimetallic coil *F* counteracts any effect on coil *C* by ambient temperature.

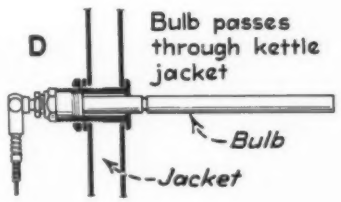
Direction of rotation of the turbine wheel, Fig 25, depends on the temperature of the driving gas. The turbine blades, of bimetal, are not held rigidly and therefore bend and reverse their direction of curvature as their temperature goes above or below the fixed control point. At this temperature the blades are straight and therefore the turbine does not rotate. Connected through a gear train the unit positions dampers according to air temperature.

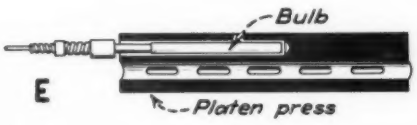
Instead of a bimetallic strip, a rod of one metal (invar or other nickel alloy) may be inclosed in a tube of another metal (brass, steel or steel alloy). Fig. 26 shows how one end of the rod fastens to expansion sleeve leaving its other end

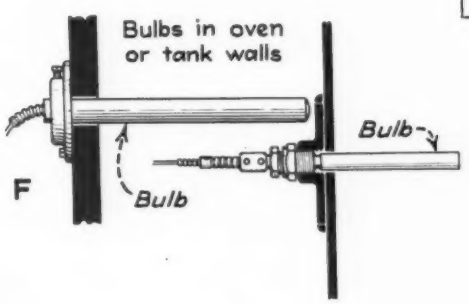


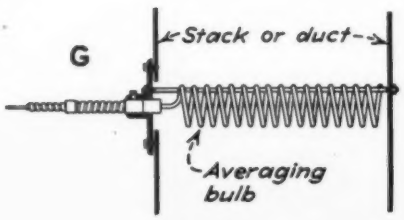


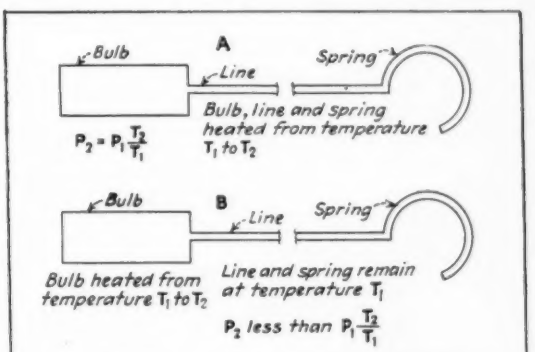






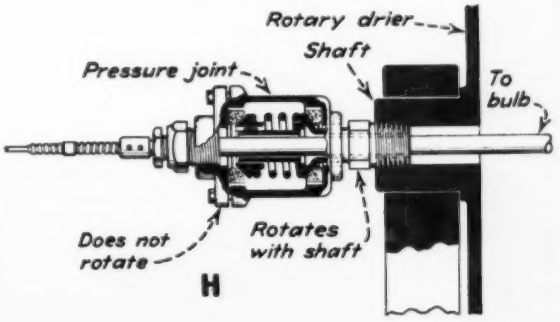






18 Pressure inside a gas-filled system increases if the temperature of any part rises

19 For best results put the thermometer bulb in such a place that flow over its entire surface is assured, and insulate outer end to prevent heat loss to surroundings. Use special fitting on drying rolls and rotating retorts



free to operate a small air valve. Since tube expands more than rod it repositions free end of rod on temperature changes. Units with brass sleeves operate in temperatures up to 300 F; those with graphite sleeves are good for 1000 F.

The resistance thermometer consists of a carefully made coil of nickel or platinum wire having a relatively high coefficient of resistance which serves as the sensitive element, Fig. 27. Connected into a Wheatstone bridge circuit, the resistance of the coil is compared to that of a standard resistance either by automatically adjusting the bridge or by the deflection of a galvanometer. Since the resistance of the sensitive-element coil is always the same at a given temperature and changes with the temperature the indicating or recording instrument scale can be calibrated in degrees of temperature.

The simple indicating-instrument circuit, Fig. 28, *A*, uses a millivoltmeter calibrated to read temperature and connected across two junction points of the bridge. A battery or other dc source connects to the opposite points. Coils *a*, *b* and *c* are standard resistances mounted near the instrument and *x* is the sensitive coil. Resistance of all four coils is usually the same at room temperature and any variation in ambient temperature changes the value of the three instrument resistors, but this change is slight and usually can be disregarded. Main change occurs in the sensitive coil which upsets the bridge balance and deflects the millivoltmeter pointer.

EQUATIONS FOR TEMPERATURE CONVERSION

For temperatures below freezing, thermometer temperature must be read as plus or minus and the problem solved algebraically.

Temperature F = 9/5 C + 32

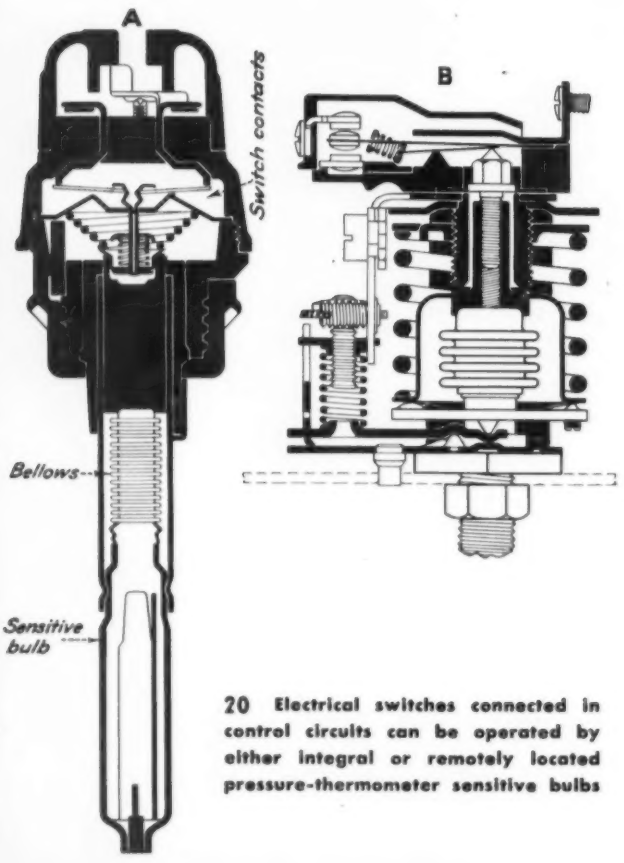
Temperature C = 5/9 (F − 32)

Another instrument, Fig. 28, *B*, mounts balancing resistors *S* and S_1 on a disk and automatically adjusts them according to galvanometer deflection to bring the instrument pointer back to zero. Position of resistor disk indicates the temperature. Calibration is such that at any disk position resistance between contacts *V* and V_1 is always equal to that between V_1 and the junction A_1. Thus ratio *a*/*b* is always unity.

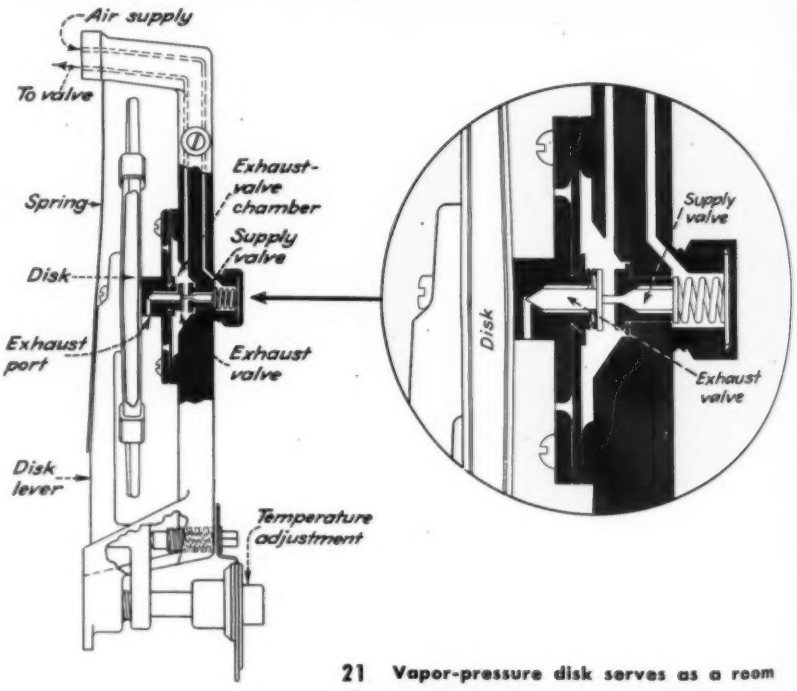
When the disk is rotated to reduce galvanometer deflection to zero, resistance between contact *V* and junction C_1 is equal to that between junctions C_1 and A_1. Thus an increase in sensitive-coil resistance caused by a temperature change is balanced by including more of the slidewire *S* in the *r* arm of the bridge. Accurate indications are obtained by carrying three leads from the instrument to the sensitive coil. Two of the leads, of equal resistance, go from opposite arms of the bridge to the coil and the third (current supply) has no effect on bridge balance. The 2-lead system is rarely used because variation in wire resistance affects the bridge balance.

Lead resistance normally varies only with ambient-temperature changes so the 3-lead system does not upset bridge balance because the same resistance change takes place in two arms of the bridge and hence they cancel each other. Resistance thermometers are good for -330 to 1800 F, and the sensitive element can be a considerable distance from the indicator or recorder. (Distance is limited only by resistance of the leads.)

Pyrometric instruments that measure temperature operate on the (1) fusion (2) calorimetric (3) thermoelectric (4) optical and (5) total radiation princi-



20 Electrical switches connected in control circuits can be operated by either integral or remotely located pressure-thermometer sensitive bulbs



21 Vapor-pressure disk serves as a room thermostat to control a pneumatically operated valve that supplies steam to the heating system. The enlargement shows construction

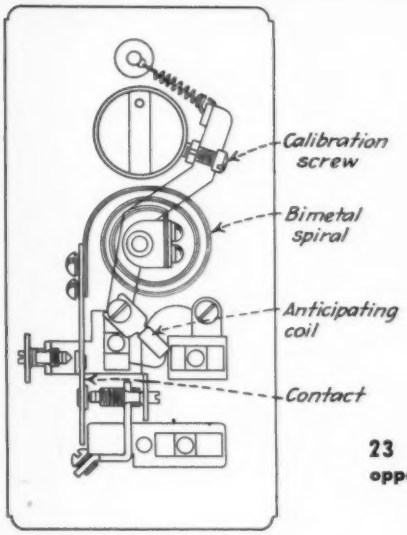
ples. Fusion cones, made of material having a definite melting temperature, serve for checking furnace temperatures and, when mounted on an insulated rod, for testing live electric conductors and switches for heating. In calorimetric devices the temperature rise, of a known weight of water in a container of known weight and specific heat, is used to calculate the temperature of a metallic article, of known weight and specific heat, placed in the water.

Thermoelectric devices consist of a millivoltmeter or potentiometer circuit, which includes a thermocouple as the sensitive element. The thermocouple is made by fusing one end of two dissimilar metal wires together. The free ends (cold junction) then connect to indicator circuit and the fused end (hot junction) placed where the temperature is to be measured. When the hot junction is heated so that its temperature is higher than that of the cold junction a small voltage is generated and a current flows in the closed circuit, Fig. 29. Since the voltage generated is proportional to the difference in temperature between the hot and cold junction the indicator scale can be calibrated directly in degrees. Cold-junction temperature is assumed to be 32 F and compensation is added to the instrument to correct for variations, or the cold junction temperature must be measured and a correction factor used.

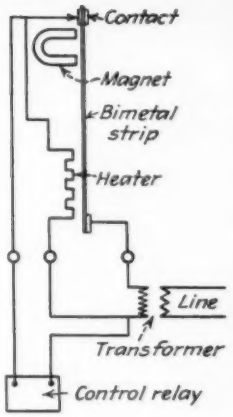
COLD JUNCTION

When copper wires connect the thermocouple to the instrument, cold junction is at the point where the wires connect to the thermocouple leads. If the dissimilar metal wires that form the thermocouple run to the instrument or selector switch, cold junction is at their terminals. Thermocouple-metal wires must always be used for leads to instruments that contain cold-junction temperature compensators. Copper and copper-nickel alloy wires serve as leads for platinum and platinum-rhodium thermocouples because they have similar thermoelectric characteristics. Cold-junction correction can be made by a bimetallic element that shifts the pointer zero, a copper-nickel coil whose resistance varies with temperature, Fig. 30, *A*, or a manual rheostat, Fig. 30, *B*.

If instrument has no means of adjusting for variations in cold-junction temperature, results are best if this temperature is held constant. Otherwise instrument is inaccurate because the points where thermocouple wires connect to the leads or instrument terminals (cold junction) act as additional thermocouples that generate voltage in the circuit. Holding the temperature con-

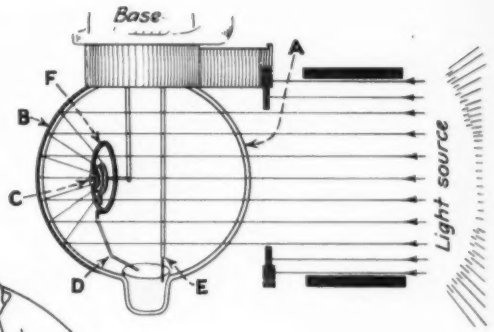


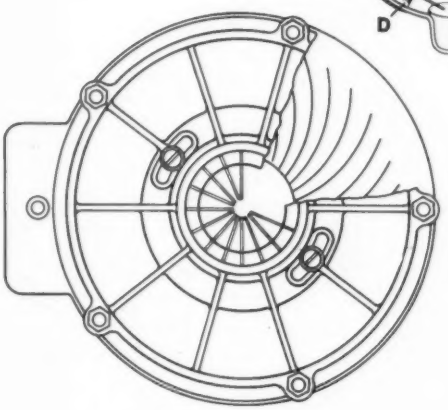
22 Coiling the bimetal strip gives greater contact movement per deg

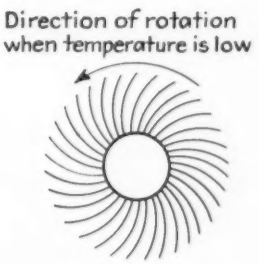


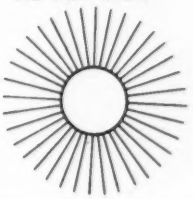
23 Anticipating coil (electric heater) opposes magnet to help open contacts

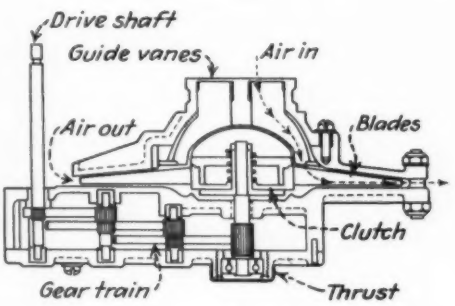
24 *(right)* Bimetal acts as a flame-failure switch

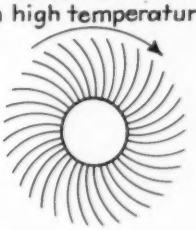




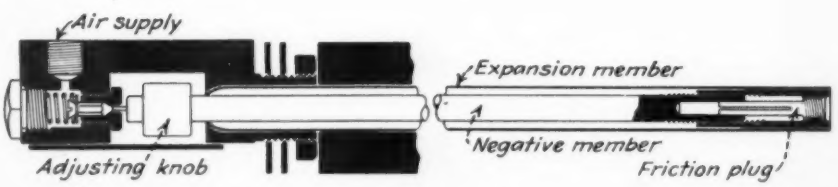




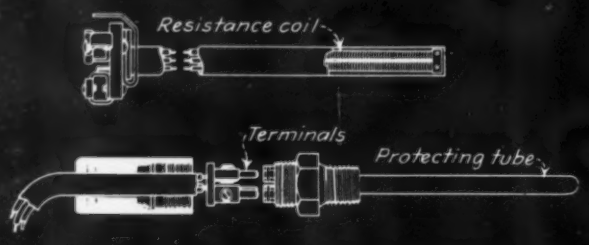




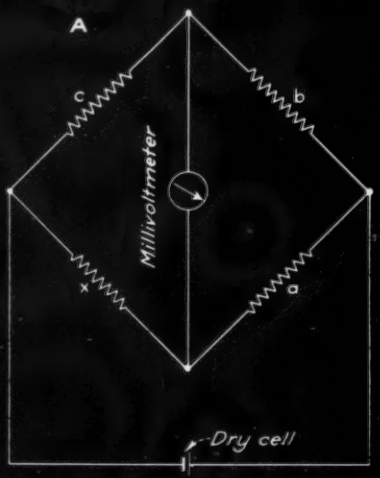
25 Bimetallic turbine blades are held rigid at only one point and are free to curve according to the temperature. Turbine then opens or closes the dampers

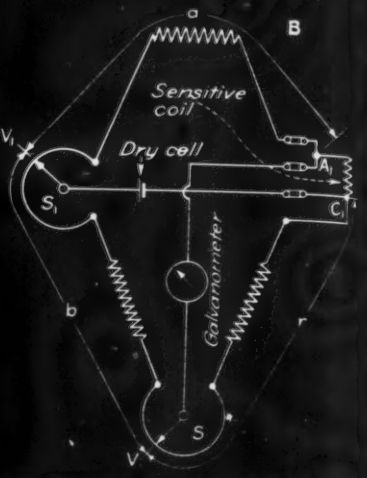


26 A metal rod having low coefficient of expansion fastens to one end of a high-coefficient-of-expansion tube to control an air valve

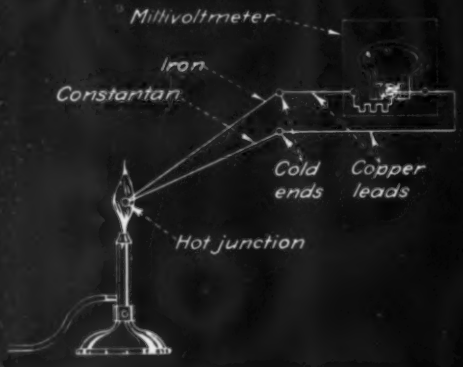


27 Resistance search coils with terminals

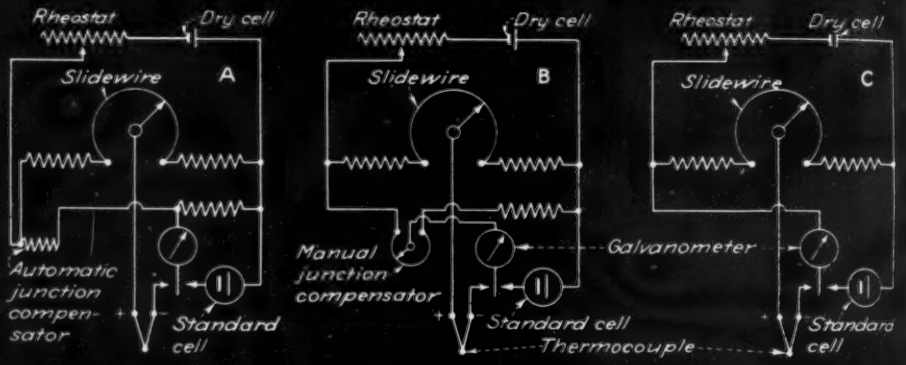




28 Wheatstone bridge showing resistance relationship used with 3-lead coil

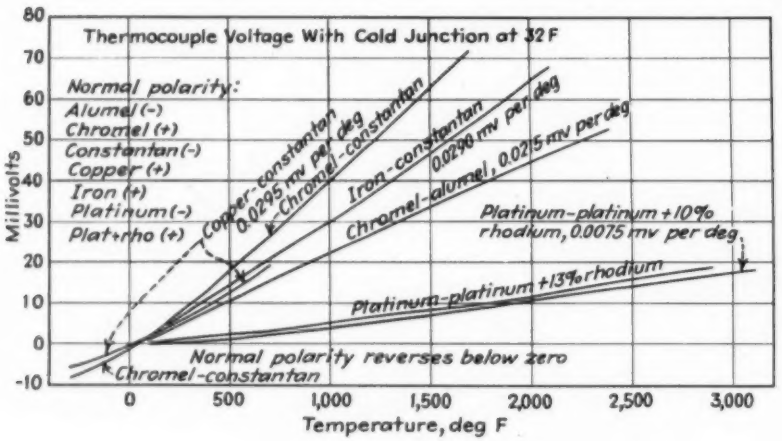


29 Heat at the hot junction of thermocouple generates voltage in the meter circuit



30 Bimetallic strip, resistance coil or a manual rheostat corrects for cold-junction temperature

31 Thermoelectric power of different thermocouples



stant keeps this voltage at one value and permits using one correction factor with meter indications. For practical purposes the factor is 1 F for each degree of difference between the cold-junction temperature and that at which it was calibrated. For platinum, use 0.5 F.

There is considerable difference in the voltage generated by thermocouples made from various metal combinations, Fig. 31. The emf per degree rise in temperature is the thermoelectric power of a couple and is used as a basis of comparison for the different types. In general a couple having low thermoelectric power, Fig. 31, requires a delicate instrument and one possessing greater power has broader utility. Because perfect junction of the two metals is a necessity, clean the two wire ends down to bright metal and twist them together tightly two or three times for additional support. Use an oxygen-illuminating-gas torch adjusted to give a neutral flame. Hold twisted junction in the flame until both wires are a dull red, then dip them in borax flux (no flux on platinum couples), return to flame.

Keep the wire whose melting point is highest in hottest part of the flame and manipulate until both wires melt into a bead, Fig. 32,*A*. The bead may also be formed with an electric arc by connecting the thermocouple wires to the positive electrode and drawing the arc with a graphite pencil connected to negative electrode. Platinum couples are usually annealed at 2700 F by passing electric current through them for several hours.

Thermocouple protection, Fig. 32, *B*, consists of (1) wire insulation (2) primary tube to protect element against contaminating atmospheres (3) secondary tube to protect primary tube against breakage.

Although it is possible to measure thermocouple temperature with a millivoltmeter the method introduces the resistance of leads and connections. Consequently a potentiometer circuit, as in Fig. 30, *C*, is considered best. Here current from a battery flows through the main circuit of fixed resistors and slidewire. By means of the throw-over

switch a standard cell is periodically connected into the circuit through the galvanometer and the instrument standardized by adjusting the battery rheostat until galvanometer deflection is zero. With throw-over switch in opposite position thermocouple is connected to the instrument and galvanometer balanced by moving slidewire. When potentiometer circuit is balanced no current flows through thermocouple leads and the effect of their resistance is nil.

Current generated in a thermocouple can also operate control valves or relays in signaling systems. Unit in Fig. 33 is mounted at the pilot burner and holds the magnetic valve open as long as the burner is ignited. If flame fails magnet is deenergized and valve closes.

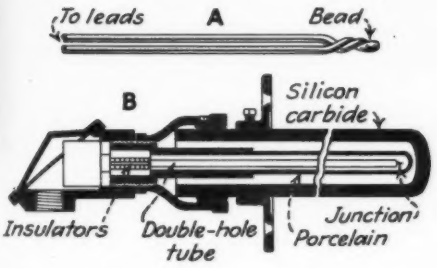
Since thermocouples are unsatisfactory for measuring temperatures above 3000 F, instruments that use the radiations from a hot body have been developed. One device measures the intensity of all radiations and another the intensity of those of one wave length.

The total-radiation pyrometer concentrates the rays from a particular area of the hot body on a thermocouple or thermopile (group of thermocouples in series) and the thermocouple potential indicates the intensity of all radiation reaching it. Unit in Fig. 34, *A* consists of a nonreflecting tube, conical mirror and concave mirror that concentrate the rays on a thermocouple. Fig. 34, *B* uses a mirror and Fig. 34, *C* a lens to concentrate the rays on a thermopile. Latter device has a nickel coil to compensate for variations in cold-junction temperature. Devices of this kind are available as indicators, recorders and controllers.

The optical pyrometer compares the intensity of radiation from a standard source with that emitted by the body whose temperature is being measured. Many types are available but the commonest method of doing this uses the disappearing-filament, Fig. 35, *A*. Light from the hot body enters the lens and is viewed through the eyepiece. Temperature of the filament is then altered by adjusting the rheostat until the filament outline just disappears into the background of the hot object. Filament current deflects meter pointer over a scale calibrated in degrees. Fig. 35, *B* uses a potentiometer to measure filament current. The operator, after regulating filament brightness by adjusting the rheostat balances the potentiometer with the slidewire, which is calibrated directly in degrees.

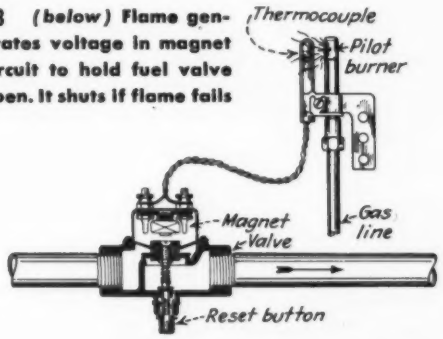
For temperatures of 1400 to 2250 F, filament and object are compared directly; for higher temperatures the operator inserts a calibrated screen between the filament and hot object to reduce the brightness to a point comfortable to the eye. This slight disadvantage is overcome by photoelectric tubes, Fig. 36, which eliminate the need for visual comparison.

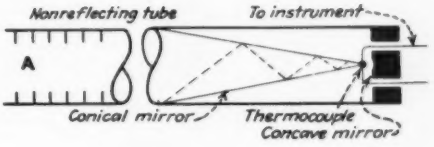
Tubes *A* and *B* measure light from a standard lamp and the hot object for comparison. Both tubes form part of an ac bridge that includes an amplifier tube instead of a galvanometer. Light from the hot body in striking tube *B* varies its resistance and unbalances the bridge. Amplifying tube adjusts comparison-lamp current flow to balance the bridge. The indicator then measures lamp current in terms of measured temperature.

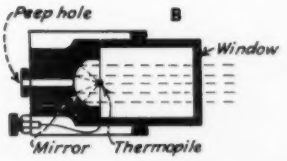


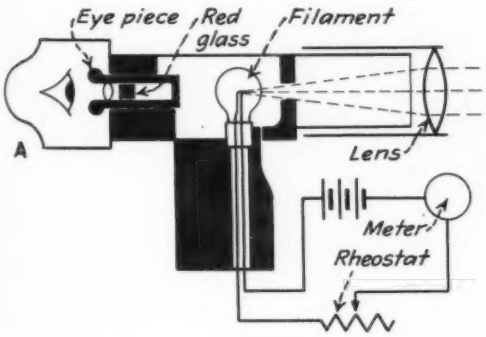
32 (above) Hot junction is twisted tightly and fused into a solid bead

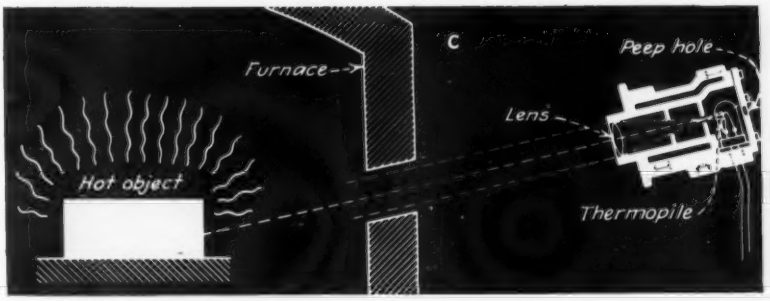
33 (below) Flame generates voltage in magnet circuit to hold fuel valve open. It shuts if flame fails

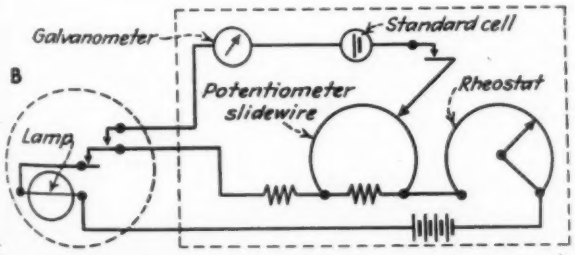




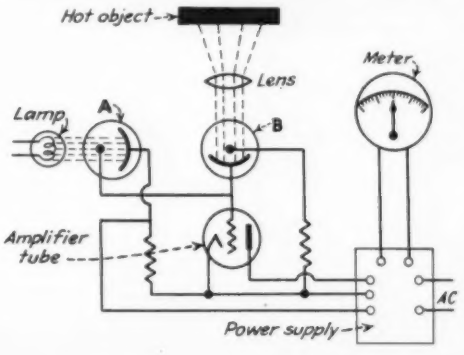








35 Optical pyrometers serve to compare the intensity of radiation from a standard source with that emitted by the body whose temperature is measured



36 Pair of photoelectric tubes compares the lamp filament and the hot object to be measured

34 (above) Total-radiation pyrometers concentrate all the radiation emitted by a hot body on a thermocouple or thermopile (series of thermocouples). Voltage generated in latter indicates temperature. Some units use a mirror while others use a lens to concentrate the rays on the thermocouple junction

Temperature Valves

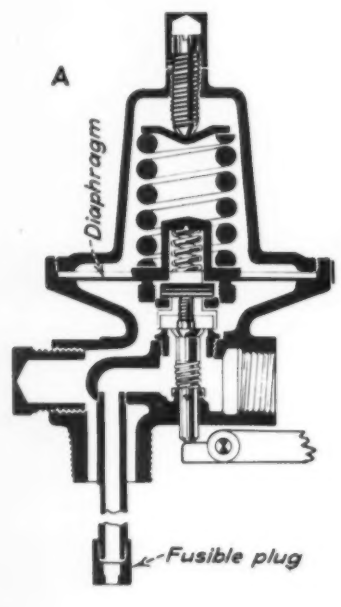
Wherever power-plant or process work calls for heat or cold, temperature-control valves have an important job. Although the common diaphragm valve may be hooked up with special automatic devices to control temperature this article describes only those valves actuated by the effect of temperature changes on their self-operated mechanisms. Inner-valve construction is the same in all types (see "Measuring and Controlling Liquid Level," POWER, April 1945, p 63).

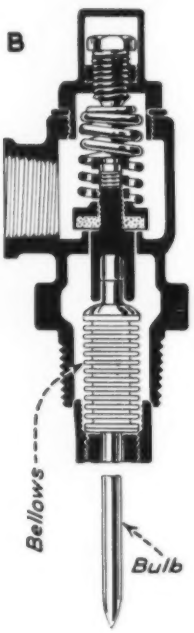
Operating motors are either bellows or metal-diaphragm units using liquid or gas expansion or vapor pressure for the actuating medium, as in pressure-operated thermometers described previously. Most diaphragm valves have a sensitive bulb and capillary tube whereas bellows units either have the operating fluid contained in bellows or have a connected capillary and sensitive bulb.

Simplest of all are the temperature-relief valves, Fig. 1. Unit *A* uses an ordinary fusible plug for temperature relief and a spring-opposed diaphragm-operated valve for presssure relief. Either can function without interfering with the other. Only objection is that this device must be removed from the vessel to replace the fusible plug after it melts from high temperature. A different design, *B*, uses a bellows containing a volatile fluid as the actuating element. High temperature causes bellows to expand and lift valve off its seat, but when temperature returns to normal it closes and is again ready for service.

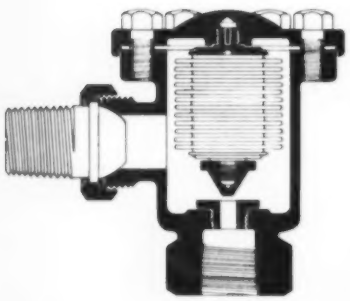
These valves protect hot-water tanks where faulty heater operation may permit excessively high temperatures which, upon tank rupture, cause serious explosions. They also serve on air-compressor discharge lines to release air and give warning of internal fire or cooling-water failure. Bellows is adjustable and fusible plugs are available for a wide temperature range.

Three-way valves are designed to mix hot and cold liquids, divert flow through either of two lines or, in reverse, to maintain desired temperature in compressor and internal-combustion-engine jackets, condensers and unit coolers. Fig. 2,*A* uses a piston valve and passes the mixture around the operating bellows. Unit *B* has a balanced poppet and *C* a single-disk inner valve. Both may be operated by a bellows and bulb arrangement or a rubber diaphragm with external control. For mixing purposes, pressure in both supply lines should be about the same to keep the plug as nearly balanced as possible. In this

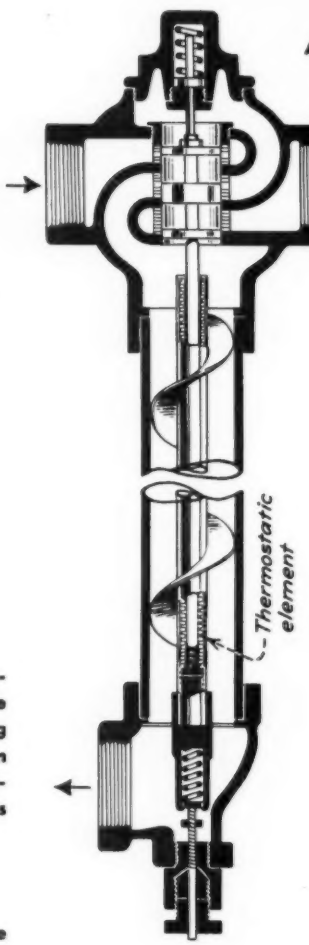


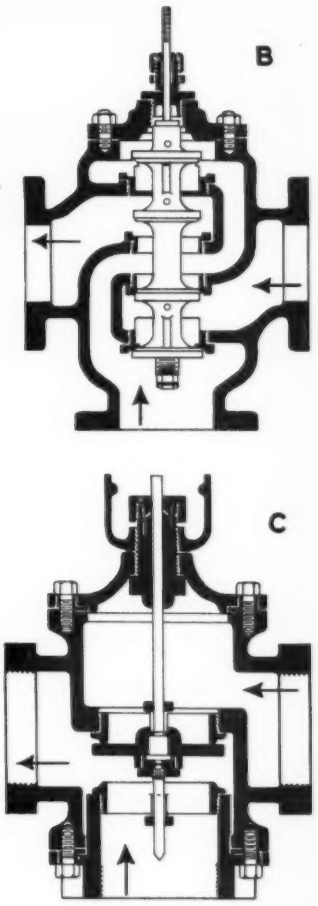


1 *(above left)* Temperature-relief valve employs a fusible plug Another design *(above)* has temperature-sensitive bellows

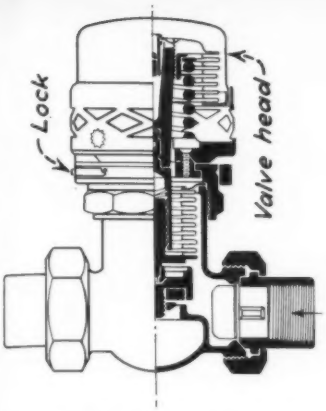


3 *(left)* Select the thermostatic trap having best filling agent

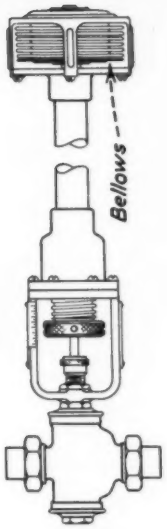




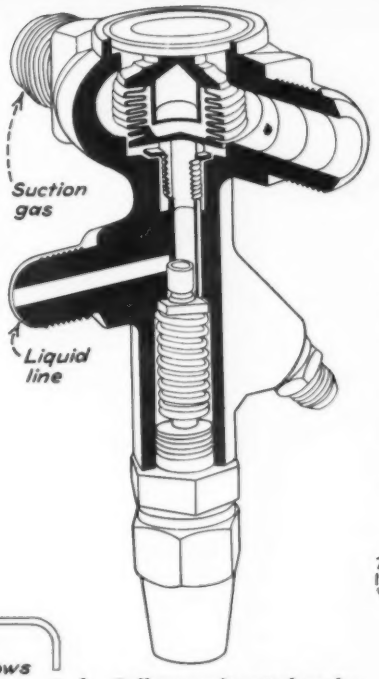
2 Inside construction of 3-way or mixing valves: a piston valve *A*, balanced poppet *B*, single disk *C*



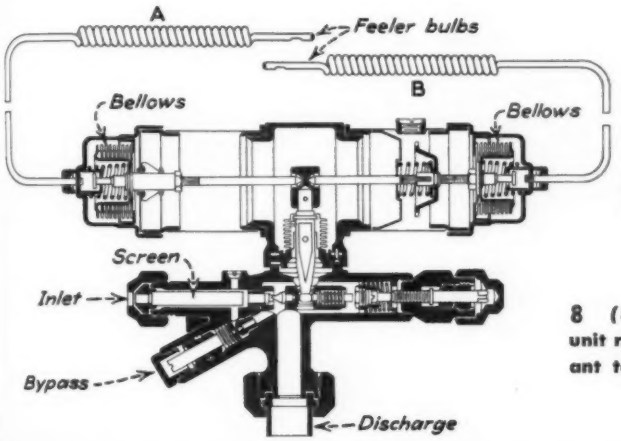
4 Thermostatic-bellows-operated valve for heating radiators.



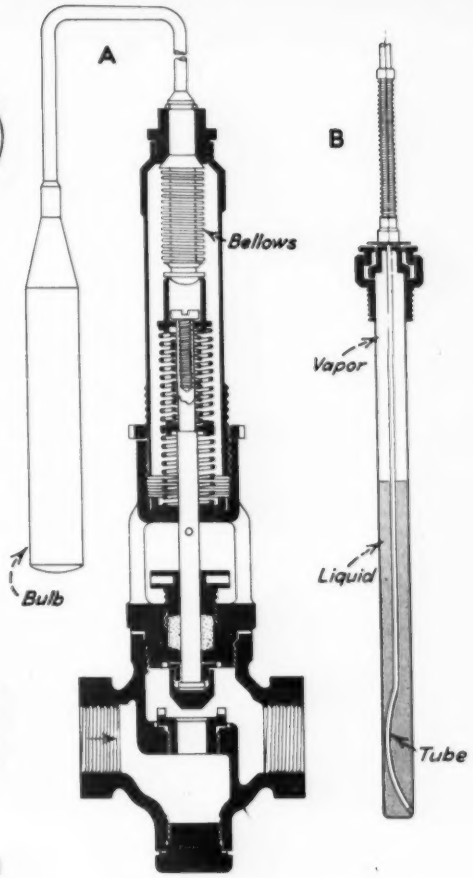
5 *(right)* Actuating bellows can mount inside tank or vessel



6 Bellows unit acted on by suction gas regulates liquid flow to refrigerating-system evaporator to hold superheat



8 *(left)* A differential-control unit regulates flow of the refrigerant to keep the evaporator filled



7 In vapor-pressure-actuated valve capillary tube and bellows remain completely filled with volatile liquid

capacity a 3-way valve is a throttling device balancing the flow from both sources to maintain uniform outflow.

When diverting flow, valve disk closes one or the other port. To maintain engine-jacket or condenser temperature, flow goes through the valve in reverse and it acts to recirculate most of the hot water adding only enough cool water to maintain desired temperature in the cooled apparatus.

The radiator trap, Fig. 3, uses water as the thermal-sensitive filling medium so that its reaction parallels all conditions of pressure and temperature in the steam system. Since the bellows functions inside its free length, the unit expands and closes the valve if rupture occurs. This causes the heating unit to cool, which gives immediate notice of trouble. For low-pressure service, bellows is of brass or bronze; for pressures above 25 psi, of nickel alloy.

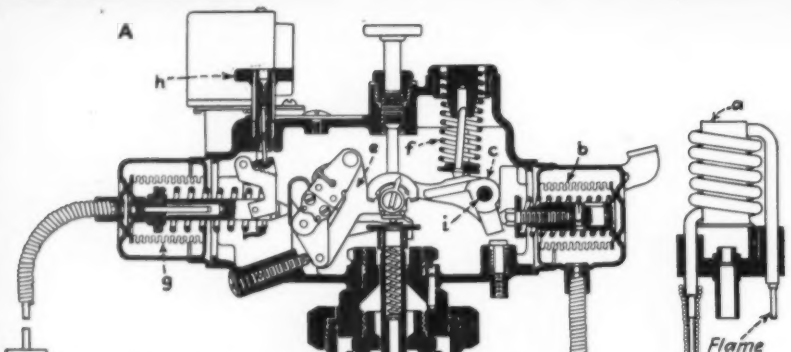
Radiator-inlet valve, Fig. 4, uses a bellows seal instead of stem packing. Monel actuating bellows contains a sensitive, expansible liquid, sealed in under vacuum, suitable for steam pressure up to 15 psi. These valves are factory adjusted to control at any desired temperature between 60 and 75 F. Temperature is set by turning valve head, which increases or decreases spring tension on bellows. Setting can be locked to prevent tampering. These units replace manually operated ones to give throttling control of steam in relation to room temperature acting on the sensitive bellows. Thermostatic element is insulated against heat transfer from steam piping.

Arrangement is slightly different for a concealed radiator. Here the control uses a bulb that mounts at the cool inlet grill, and a bellows control located at the heated-air outlet. Both units connect to the bellows-operated valve through capillary tubing and act in unison to throttle steam supply and maintain desired breathing-line temperature.

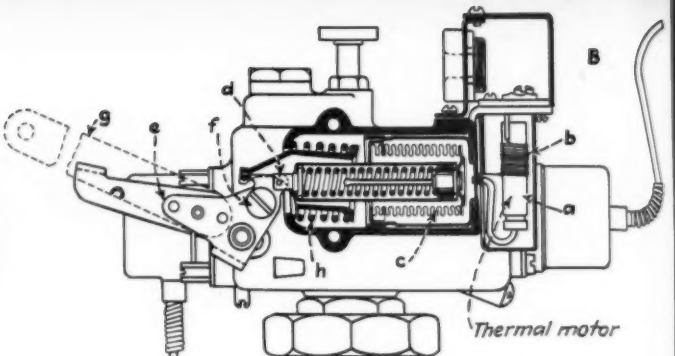
Bellows units are adaptable for mounting in the open atmosphere or for controlling the temperature of liquids in open tanks or vats. In chemicals liable to attack the bellows or liquids carrying suspended matter a protective cap covers the sensitive element. Fig. 5 shows the extension stem that permits locating the sensitive element inside a tank. Thermostatic end is removable and only installation requirement is to drill a small hole in the tank.

An integral-bellows device, Fig. 6, acts as an expansion or throttling valve for refrigerating-system evaporators. Control is by exit-gas temperature. Suction gas, on its way to the compressor, passes over the actuating bellows. It contains a thermal sensitive fluid that reacts and positions the valve to admit more or less refrigerant according to gas-temperature variations. Accurate control of gas superheat provides maximum coil capacity at all times and helps the evaporator deliver more nearly its rated capacity.

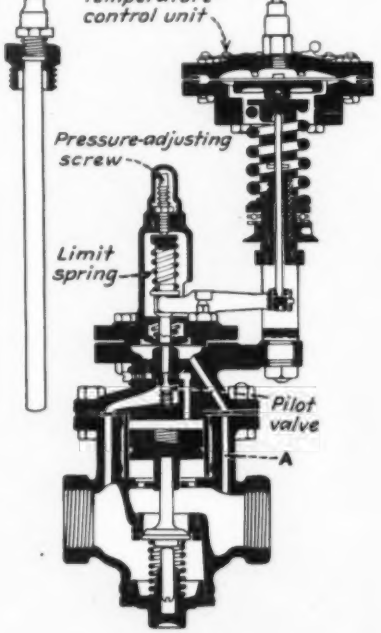
Bellows-operated valves complete with capillary and bulb, Fig. 7,*A*, regulate temperature in refrigeration, air-conditioning, heating and condensate-removal work. In the latter, the bulb is placed in the fluid being heated so that when it reaches optimum temperature the valve closes and condensate backs up in the steam jacket. Thus by flooding or draining the coil or jacket effective heating surface is changed in direct relation to the load. Thermostatic element is liquid filled and valve acts gradually to give true throttling control.



9A Water bulb and flame-failure side of controller of gas-fired hot-water system



9B Side view of 9A showing thermostat-controlled heater on the sensitive element



10 Combined pressure-reducing and temperature-control valve

In vapor-pressure-actuated valves the capillary tube extends to the bulb bottom, Fig. 7,*B*, so tube and bellows always remain filled with liquid. If vapor passes over to the bellows, it may act as a condenser and lower the pressure until enough liquid accumulates to fill it. In the meantime the valve acts erratically.

Low-temperature refrigeration expansion valve, Fig. 8, uses a bellows and sensitive element *A* that connects to evaporator inlet and another unit, *B* (for superheat temperature) that connects to evaporator outlet. Difference in temperature between these two elements governs the flow of refrigerant to keep the evaporator filled during compressor operation. Both power elements are charged with ethane and their pressure changes about 1 psi for each degree change in feeler-bulb temperature at 100 F. This allows the valve orifice to be relatively small with the needle working far off its seat, which minimizes plugging from moisture, dirt or wax.

Design is such that main-valve orifice opens only when superheat feeler bulb is warmer than evaporator bulb by an amount equal to differential setting. Thus on start-up some means must be incorporated to create a temperature difference between the bulbs, or the valve will not open. This is accomplished by the bypass valve, which remains open and feeds a constant supply of refrigerant. When system is shut down a solenoid-operated or other automatic valve must close the main liquid line.

Unit in Fig. 9,*A* functions as the central control for a gas-fired hot-water heating system. Only electric circuit is that from the space thermostat to a thermal motor inside the mechanism. As long as pilot flame burns, heat applied to sensitive element *a* expands bellows *b* and raises bell crank *c*, which permits spring *d* to open the valve through snap-action mechanism *e*. Spring *f* closes valve with a snap if pilot flame fails. Bellows *g*, adjusted through knob *h*, closes the valve if water temperature exceeds throttle setting. On a decrease in temperature the bellows snaps the valve open.

Another view, Fig. 9,*B*, shows the thermal motor *a* controlled by a room thermostat. Current passing through resistance *b* vaporizes liquid in the bulb, which increases the pressure on bellows *c* and forces stem *d* to the left. This rotates rocker *e* around shaft *f* to operate damper arm *g*. Another lever (not shown) connects to shaft *i* in Fig. 9,*A* to operate snap-action mechanism *e* and open the valve. When electric circuit opens or current fails pressure on bellows *c*, Fig. 9,*B*, falls and spring *h* reverses the operation.

Action of throttling element opens or closes the gas-supply valve gradually until it passes sufficient fuel to maintain the desired temperature under existing load. Throttling movement starts at the temperature as set with knob *h* in Fig. 9,*A*.

The combination unit, Fig. 10, puts the pressure-reducing and temperature-regulating functions into one body. Setting of pressure-adjusting screw determines maximum value of reduced pressure. Limit spring acting downward opens pilot valve and admits high-pressure fluid to top of piston. When piston opens main valve, reduced pressure flows up passage *A* to underside of metal diaphragm. This balances limit-spring loading to adjust the pilot valve. Temperature control comes from the upper diaphragm, which is actuated by vapor pressure generated in the sensitive bulb. Downward movement of the diaphragm (high temperature) acts through the stem and lever to oppose the pressure-reducing limit spring. This lightens downward force on pilot-valve diaphragm, and the reduced pressure then raises the diaphragm enough to reposition the pilot valve and throttle the main valve according to temperature requirements.

Bellows-operated valves and dampers serve in installations using pneumatic thermostats or controllers. Here air pressure acting on the bellows is regulated by bleedoff through an orifice. These devices can be arranged to give either throttling or on-off operation.

Control Systems

Fundamentally all automatic control problems are somewhat similar. It usually requires only an exchange of sensitive elements to adapt a controller for either pressure or temperature work. Every system has at least two parts — sensitive element and power unit. The first sees or feels something and the second says or does something about it. Frequently both are combined in one unit. For example, a metal bellows containing a volatile fluid expands when its temperature rises, and operates the stem of a valve to shut off or throttle the steam supply. While such units are sturdy and dependable, many processes require devices that provide finer control adjustments.

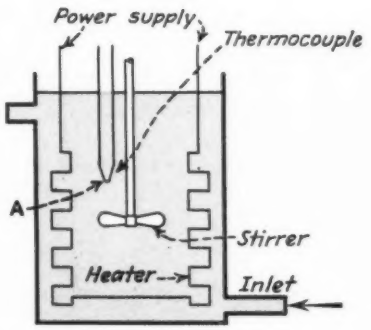
For a start a third element — an amplifying device — is needed. It makes large forces out of small to control the application of electricity and liquid or gas pressure to the valve power unit. Commonest forms of the latter are diaphragms, pistons, solenoids and electric motors. Their stems or shafts connect directly or through levers, wires, pulleys or gears to valves, dampers or rheostats.

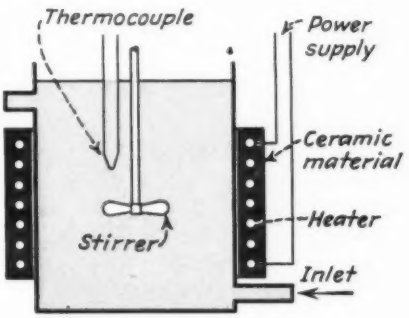
The temperature-control problem in a continuous process is one of matching heat-supply rate to that of heat demand in the face of interfering factors such as storage-capacity, transfer and distance-velocity, and controller lags. Storage capacity, either as fluid volume or heat content, acts as a balance wheel tending to keep the system in equilibrium. Storage capacity can be either the liquid that is being heated or the apparatus through which heat transfer takes place, but the effects differ.

Stored heat in a large tank of liquid may permit wide variation in rate of throughflow or heating without seriously affecting liquid temperature. On the other hand the brickwork of a heat-treating furnace has high heat-storage capacity. If heat input is higher than conductivity rate of the metal being treated the walls absorb heat faster than the metal and the controlled temperature overshoots. Thus having a high demand-side storage-capacity lag helps maintain a uniform temperature after the process is in operation but a high supply-side storage-capacity lag makes it difficult to establish proper balance between supply and demand.

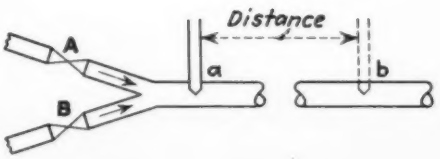
Fig. 1 shows the effect of demand-side storage lag. Electric heater has large surface area and the stirrer keeps both heater and water at substantially the same temperature. A change in power supply to the heater is almost instantaneously evidenced by a changed water-heating rate. Assume rate of flow and temperature of inflow fixed, electrical-heat supply constant, and temperature at *A* perfectly steady. Now let a sudden change in the heat supply take place. The water temperature does not rise to a new steady value immediately, dotted line in Fig. 4, but follows curve *a* or *b*, initial rate of increase, depending upon the water's heat capacity. Retardation in temperature response resulting from this capacity effect is the demand-side storage lag.

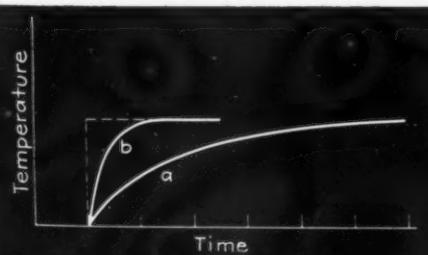
When thermal resistance prevents free heat flow from the point of storage to that of measurement it introduces transfer lag, Fig. 2. Here the heater is embedded in ceramic material outside the tank. Assuming that each element has both thermal resistance and thermal



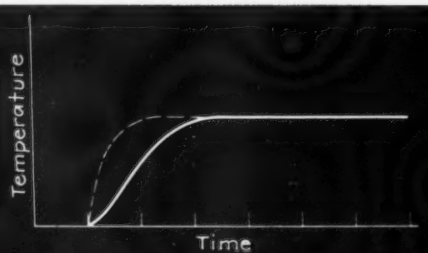


1 Large heat volume stored in the demand side permits variation in throughflow or heating. 2 Thermal resistance between the fluid and heat source causes lag. 3 *(right)* Distance lag shows if sensitive element is too remote

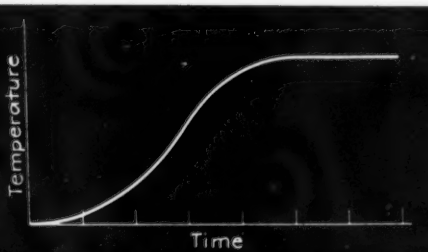




4 When heat input in Fig. 1 increases, water temperature rises as at *a* or *b*



5 A sudden increase in heat on Fig. 2 raises the temperature along solid line



6 Cumulative effect of process lags introduces process dead-time period

capacity, a new rate of heat supply can be established instantly to the heater, but considerable time elapses before it is fully effective within the tank. As a result, a sudden change in supply produces a temperature response as indicated by solid line, Fig. 5, in contrast to dotted line of negligible transfer lag.

Under steady conditions with heat supply and demand equal the rate at which heat enters the bath depends only upon temperature drop across the thermal resistance separating the supply and demand sides, and is entirely independent of thermal capacity on the supply side. Increasing the supply-side heat capacity delays the feel of an increased rate of heating because it requires a longer time to build up the necessary temperature head.

Distance-velocity lag is the delay in detecting a change in the measured value because the material must be transported to the sensitive element. Moving the thermocouple, Fig. 3, from *a* to *b* introduces a distance-velocity lag. A changed setting of valve *A* or *B* is not evidenced at *b* until the new mixture covers the distance from *a* to *b*.

As previously stated, a change in heat supply, as a result of process lags (demand-side storage, transfer and distance-velocity lags) produces a temperature response similar to full-line curve in Fig. 5. At first the temperature does not change, then it increases slowly, following which the rate of change reaches a maximum value, Fig. 6. Period when no substantial temperature change occurs is called the process dead time. Cumulative effect is such that even though sensitive element signals the temperature departure, deviation continues unchecked for a short interval.

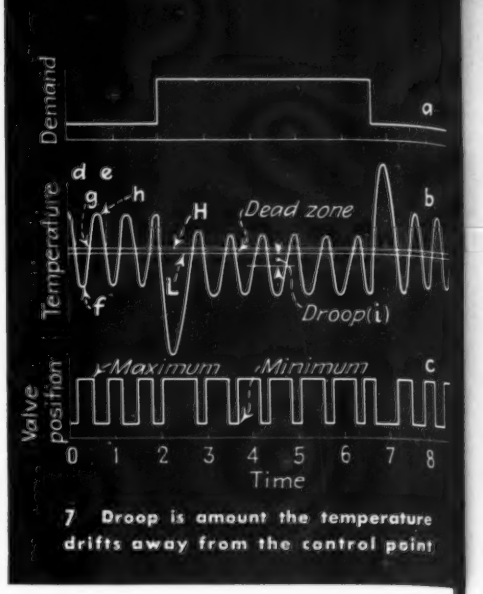
Another series of lags referred to collectively as controller lag includes the time required for: (1) sensitive element to achieve equilibrium with the new temperature (2) measuring element to become stable at its new position (3) control element to detect the deviation and send out the necessary correcting impulse (4) the valve or other final control element to reach a position in accord with the controller impulse. Whether these lags have an appreciable effect depends on each particular application.

The controller's job is to measure changes in the controlled variable (temperature or pressure) and make necessary corrections. Devices are most generally classified as:

1. Two-position
2. Proportional-position
3. Floating
   a. Single-speed
   b. Two-speed
   c. Proportional-speed
4. Proportional-plus-floating (reset)
   a. With other compensation

The 2-position controller moves the valve to either of two positions. In Fig. 7 curves *a, b* and *c* show demand, temperature and supply (valve position) respectively, plotted against time. From 0 to time 2, conditions are steady with supply and demand in balance. The valve is periodically shifted between its maximum and minimum position as the temperature falls to *L* and rises to *H*. Interval between *L, H* is control band.

In the cycle *d* to *e* the valve takes its maximum open position as the falling temperature reaches value *d*. The controlled temperature does not begin to rise immediately, but continues to drop to point *f*. It then rises to value *g* (valve moves to minimum position) and continues to rise, as a result of energy stored in the heater, to maximum value *h*. At *e* a new and similar cycle begins.

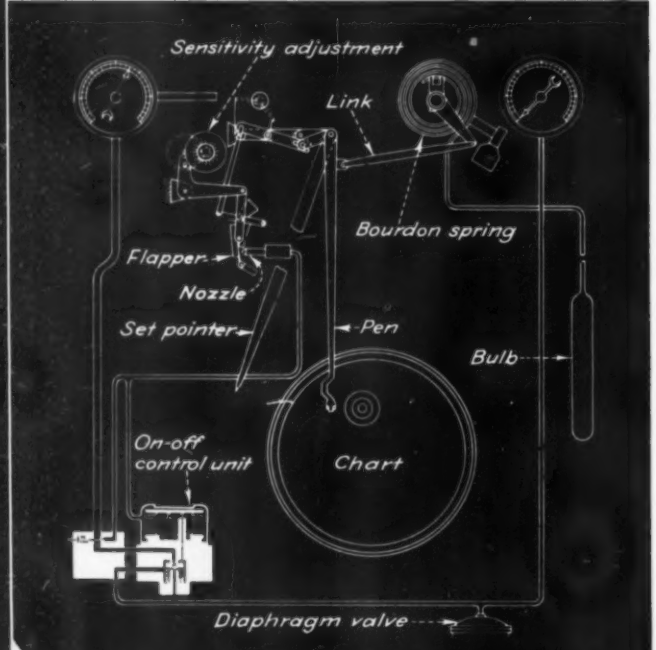


7 Droop is amount the temperature drifts away from the control point

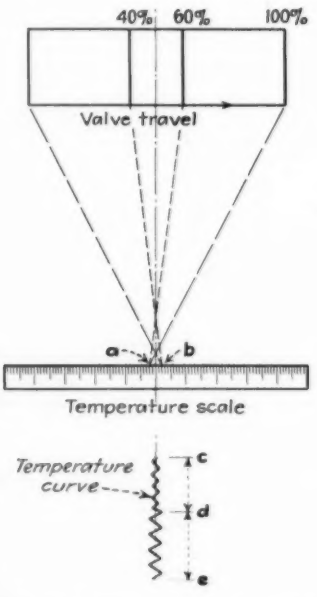
At time 2, demand suddenly increases. After a transient state extending from time 2 to about 3.5, a new, steady state is reached with supply and demand balanced. At time 6.6, demand reduces to its original value. The result is similar to that obtained when demand increased, with an overshoot in the opposite direction. These curves are typical of 2-position control in the presence of a large transfer lag. When demand-side storage lag is the only important retarding effect, the direction of temperature change reverses immediately upon a change in valve position. When demand is steady the temperature curve lies between limits *H* and *L*, and appears saw-toothed.

Time space 3 to 6.5 (on temperature curve) illustrates load error, offset or droop. In this area high and low temperatures no longer average out at the control point as from time 0 to 3 but show a lower value, *i*. Magnitude of this droop depends on the system demand.

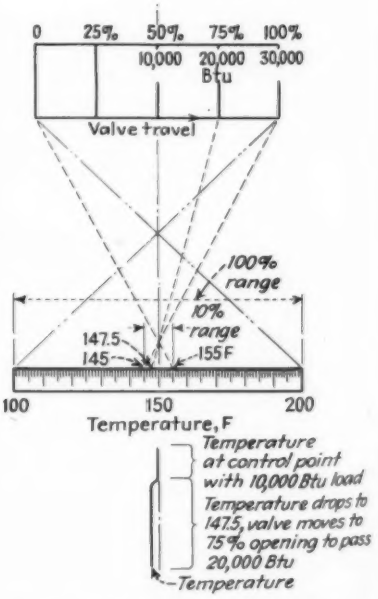
Two-position controllers recognize



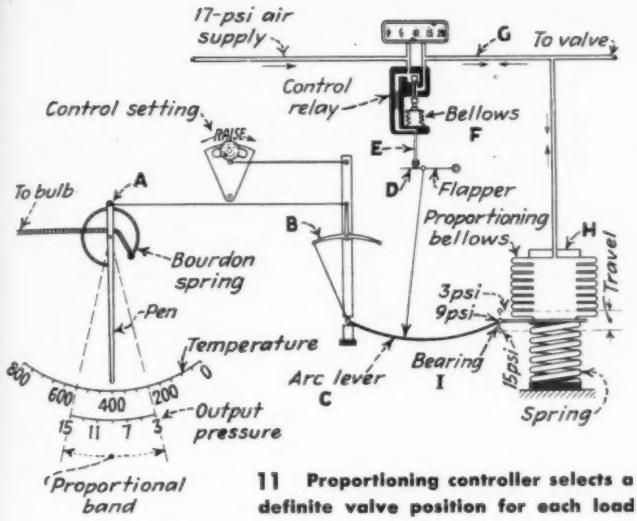
8 On-and-off controller has no throttling action



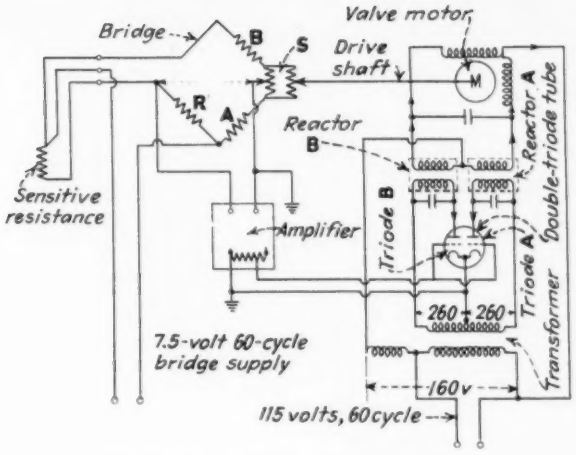
9 Control range a to b can operate valve over any percentage of travel



10 Effect of giving valve full travel and varying instrument control range



11 Proportioning controller selects a definite valve position for each load



12 Resistance thermometer uses a balancing bridge and tube power circuit

neither rate nor magnitude of load changes. They include electrical, pneumatic and hydraulic devices in which high and low contacts, or pilot-valve positions above and below the control point, open or close a valve or move it to two positions not fully open or closed. Sometimes the controlled valve is fitted with a bypass to supply minimum requirements instead of using a stop.

With these controllers the rate at which the control valve opens or closes is not adjustable; therefore the rate of supply through them is fixed and valve cannot be synchronized with rate at which system comes to equilibrium.

PNEUMATIC UNIT

In the pneumatic unit, Fig. 8, the pen in moving towards set pointer carries a flapper strip toward the orifice. This obstructs the air discharge and builds up pressure on the control-unit bellows, which then opens its valve and admits pressure to close the main valve. Conversely, when pen moves below set pointer, reverse operation occurs and main valve opens. The graph, Fig. 9, shows how a 2-position controller functions. Relation between high and low points *a* and *b* remains fixed but the amount of valve opening can be varied by adjusting limit stops. Narrowing the valve-opening range tends to straighten out the control line for a particular load.

Temperature curve *c* to *d* is obtained when travel is limited between 40 and 60% positions; curve *d* to *e*, when valve moves through its full travel.

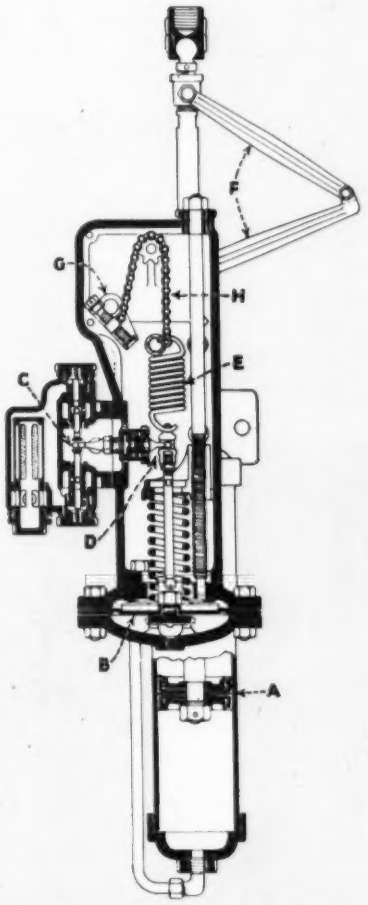
Continuous cycling of the control valve is undesirable in some processes. These require a proportional-positioning system (sometimes called proportioning or throttling) that selects a definite and different valve position for every temperature value within its working range. To accomplish this the controller has an adjustable mechanical device for proportioning the amount of valve movement to the temperature, called the throttling range. Making the range small turns the controller into practically a 2-position unit; it can be widened so that full-scale pen movement is required to full-stroke the valve. Throttling range is defined in percentage of full-scale movement of controller pen. For example, if instrument scale reads from 100 to 200 F and it is adjusted to full-stroke the valve on a 10-F temperature change, throttling range is 10%.

Consider the graph in Fig. 10, which is similar to that in Fig. 9 except that the valve has full travel, and the distance between high and low range points is varied. Assume the unit is controlling the temperature of flowing water at 150 F by throttling steam to a heating coil. With the pen at the control point (150 F) the valve is open 50% and passing 10,000 Btu per min to hold this temperature. Flow of water suddenly doubles, which means that twice as much heat must be put into it. To obtain this the valve must open to 75% position, but to get this opening the pen has to move 2.5 F from the control point (drop to 147.5 F). System then comes to equilibrium at the new temperature. The drop in temperature (2.5 F) is the instrument droop on this demand increase. The greater the throttling range the greater the droop for any given load change.

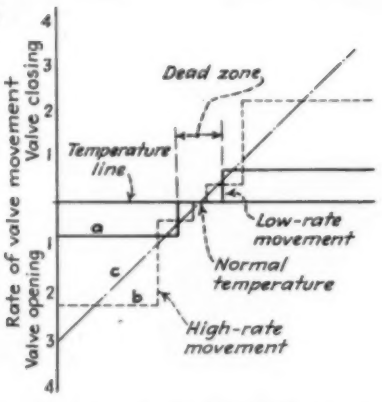
The temperature did not overshoot, showing that the system absorbed the additional heat at the same rate at which the instrument pen detected the load change. If the pen overshoots the new control point before reaching equilibrium it indicates that the rate of heat input must be slowed down by widening the throttling range. This in turn gives greater droop. Generally speaking a high percentage of unfavorable factors, such as limited storage capacity, long process lags, high thermal potentials and oversized control valves, requires greater throttling-range width.

Fig. 11 diagrams the operation of a proportioning controller. Assume the system in balance with 9-psi air pressure applied to control-valve line. The same pressure exists in proportioning bellows because it feeds from same line.

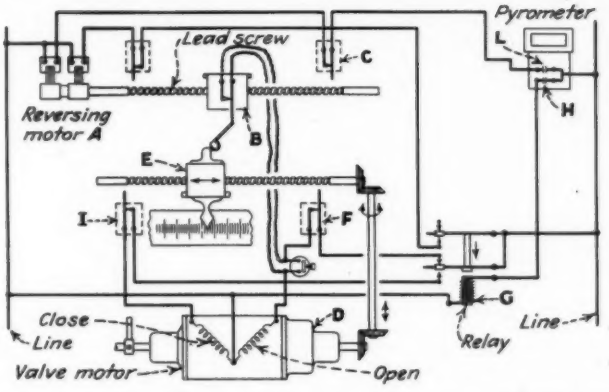
If the temperature falls, pen *A* moves reversing bell crank *B* to raise left-hand end of proportioning arc-lever *C*. This moves flapper *D* nearer nozzle *E* to throttle the free-air discharge and build up pressure in relay bellows *F*. It expands and opens relay valve to pass



13 Controller corrects for nonequal percentage flow of some valves and dampers



14 **Dead zone is the temperature variation in which no controller action takes place**



15 **The floating switchblock B determines final position of main control valve by stopping the operating motor D**

more air into control-valve and proportioning-bellows line *G*. Increased pressure in proportioning-bellows *H* causes it to expand and lower arc-lever bearing *I*, which moves flapper *D* away from the nozzle. Spring-loading bellows *H* makes the output air-pressure change strictly proportional to pen deflection.

Fig. 12 illustrates the complete control circuit for a resistance-thermometer controller using a balancing bridge and electron-tube power pack, which furnishes power to control the valve-operating motor. Unbalance of measuring bridge causes current to flow through the correct plate circuit of the double-triode tube and into the corresponding reactor to energize motor winding. Motor then positions control valve and rotates slidewire to balance bridge circuit.

With floating controllers, position of the final control valve bears no fixed relation to the temperature (or other variable) but is changed continuously or floated in the proper direction whenever the temperature deviates from the control point. Ordinarily the valve moves slowly and does not reach its limit of travel before being arrested by the temperature coming back to normal. The arrested position has no relation to the temperature so the instrument does not have a drooping characteristic. To avoid cycling, constant-valve-speed instruments have a dead zone in which no action takes place so long as temperature stays within this narrow range.

Consider the proportioning controller, Fig. 13, in service and maintaining the desired pressure. Power piston *A* is at rest. A slight change in pressure moves control diaphragm *B* and this movement is transmitted to 4-way valve *C* through lever *D*. This valve then admits gas or hydraulic pressure to one side of power piston and exhausts the opposite side so piston rod moves the valve or damper in the right direction.

At the same time this movement is transmitted through levers *F*, shaft *G* and roller chain *H* to compensating spring *E*. Its tension is thus changed to alter effective spring loading of control diaphragm *B* and bring piston *A* to rest at the correct position. Proportional range band is adjusted by changing the length of chain lever arm at shaft *G*.

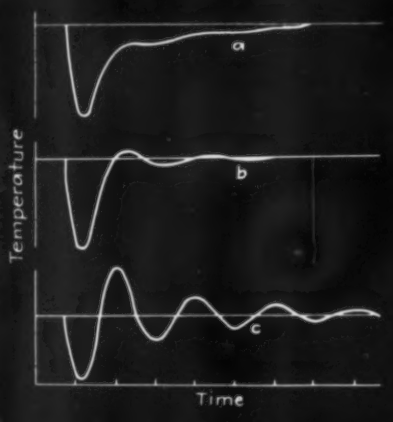
Angular relationship between levers *F*, shaft *G* and chain lever is such that when piston works near the top of its stroke a given movement changes the tension of spring *H* at a greater rate than the same movement near the lower part of its stroke. Therefore piston movement is retarded most near the top (closing) and accelerated most near the bottom (open) to correct for dampers or valves that pass almost 50% of capacity when 25% open, 75% when half open.

Single-, two- and proportional-speed floating controllers find wide use although for temperature-control work they are generally combined with the proportional-position units described previously. Single-speed controllers move the valve continuously at constant speed as long as the temperature remains outside the dead zone. Valve opens slowly as long as the high contact is made and, if the temperature reverses, remains in position where contacts opened until temperature passes through dead zone and operates low contact.

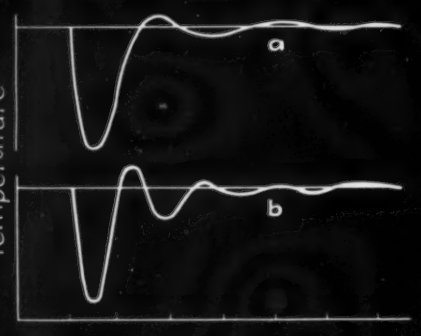
The 2-speed controller employs two valve speeds: low if deviation is slight; high if deviation is large. In the proportional-speed instrument, valve speed is proportional to pen deviation and the controller has little or no dead zone. Curves *a*, *b* and *c* in Fig. 14 show how the rate of valve motion varies with temperature deviation in single-speed, 2-speed and proportional-speed controllers, respectively. Curves *a* and *b* indicate appreciable dead-zone area while curve *c* shows none.

Controllers of this type are extremely important as an added part to proportional-position instruments where they reset controller to control point after each demand change and thus eliminate droop.

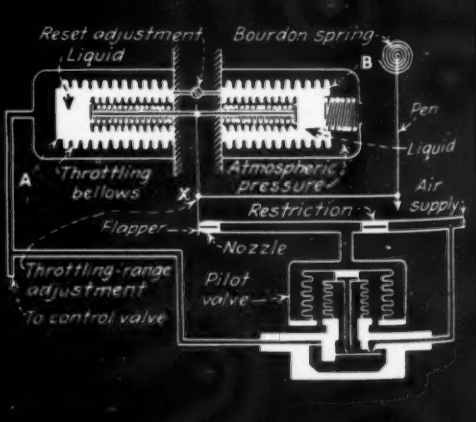
The electrical controller in Fig. 15 is



16 **Increasing floating speed (a to c) too much causes controller to cycle**



17 **Reducing the proportional or throttling-band width causes oscillation**



18 **Automatic reset attachment eliminates controller droop and holds temperature constant**

used with any instrument having a high and low contact with a neutral position between them. Wiring diagram shows this unit connected to a pyrometer. Starting with a cold furnace, contact *L* closes and energizes reversing motor *A*, which drives switch block *B* slowly across to limit switch *C*. Power motor *D* opens control valve full and moves rider *E* rapidly up to limit switch *F*. Rider *E* always travels faster than *B*.

When furnace temperature reaches the set point, contact *H* energizes relay *G*, which in turn starts power motor *D* in closing direction and reversing motor *A* to move switch block *B* to the left. As motor *D* closes fuel valve it moves rider *E* across to limit switch *I*. If temperature falls, contact *H* opens. This de-energizes relay *G* and its upper contacts close to operate motor *D* in the opening direction. *D* then opens fuel valve until rider *E* moves to the right, touches switch block *B*, and opens the switch mounted thereon. Switch breaks motor field circuit. If the temperature again rises, main and reversing motors operate to move *B* and *E* to the left. *E* travels fastest and goes to limit switch; *B* moves slowly and stops when *H* opens.

Putting proportional position (valve opening determined by the temperature or other variable) and proportional-speed-floating control (valve moves at a rate proportional to the magnitude of the temperature change) into the same controller produces a system that has the stability of a proportional controller and the constant control point of the floating unit. This controller moves the main valve at a rate whose sum is that of the rate proportional to the deviation and the rate of change of this deviation. Stabilizing influence of the proportional section eliminates the need of a dead zone in the floating mechanism, the latter correcting for the drooping characteristic of the former.

Adjustments consist of varying the intensities of the proportional-position and floating action. In some instruments, changing the proportional-band width affects the floating speed. On others floating speed has independent adjustment. Curves *a* and *b* in Fig. 17 show the effect of decreasing the proportional-band width; too great a reduction produces sustained oscillations. Curves *a*, *b* and *c* in Fig. 16 show the results of increasing the floating speed. These devices are classified as proportioning controllers with automatic reset — they eliminate droop and return the temperature to its control point after a load change. Reset response acts only when instrument pen is away from set pointer.

AUTOMATIC RESET

The controller in Fig. 18 incorporates automatic reset. Large bellows *A* is the proportioning unit; bellows *B* and both inner ones constitute the reset feature. Inner bellows are connected rigidly together through a rod that serves as the flapper pivot. Space between them on either side is liquid-filled, and the chambers connect through the needle-valve passage. Outside of bellows *B* opens to atmosphere.

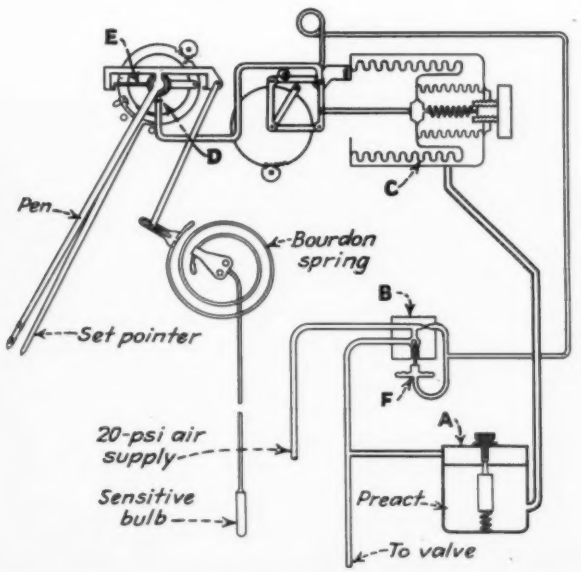
Assume the pen has moved from the control point and shifted the flapper away from nozzle, thus lowering the pressure in main control-valve line. This reduced pressure on bellows *A* permits it to move to the left, reducing the liquid pressure on that side. Liquid pressure on right side momentarily remains the same. Since *B* is free to move and maintain pressure on the liquid inside it, the unbalanced pressure forces liquid through the needle valve and into left-hand bellows. Result is to move flapper back to the nozzle. Automatic reset action takes place as soon as inside bellows has moved away from control-point position as a result of the left-side liquid being at a lower pressure.

As liquid flows from the high- to low-pressure side the pressures begin to equalize and inside-bellows system moves to the right towards its balanced position. This restoration moves the flapper to uncover the nozzle and change the control valve pressure until entire system comes back to balance and the pen coincides with control pointer. Positioning the needle valve adjusts automatic reset action. Width of proportional-range band is adjusted by moving fulcrum point *x* up or down.

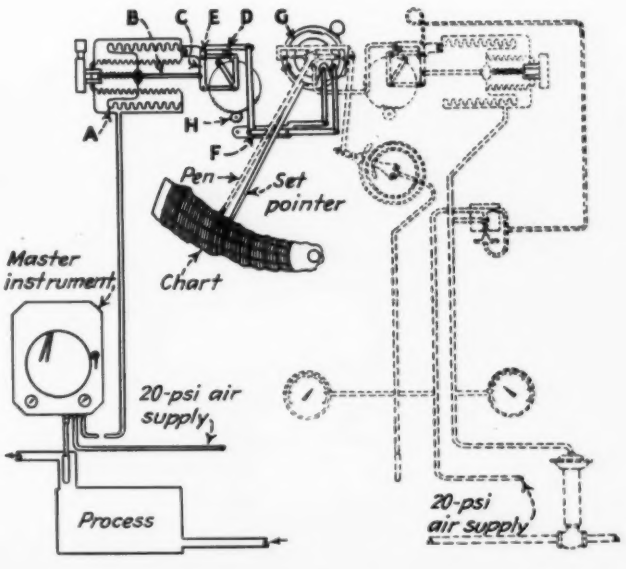
The preact attachment, when applied to proportional or proportional-plus-floating control, adjusts the valve more rapidly and moves it farther in response to sudden load changes than would otherwise occur. Since this response produces an additional output-pressure change per rate of pen movement it has a unit of preact time in minutes. Preact does not replace automatic reset since it ceases to act when pen is still.

Action is achieved by interposing a damping device *A* between relay valve *B* and follow-up bellows *C*, which retards air flow to and from the sensitivity-adjusting assembly, Fig. 19. Assume the control is at equilibrium with an output pressure of 6 psi applied to diaphragm valve, sensitivity is set for 4 psi per inch pen travel, and preact setting is one minute. Pressure outside bellows *C* is the same as on diaphragm.

Suppose the temperature begins to increase at a constant rate of one-inch pen travel per minute. Without preact, output pressure would rise at the rate of 4 psi per minute, and one minute later



19 Preact device throttles air flow to and from follow-up unit to halt nozzle travel momentarily



20 Pneumatic-set attachment moves controller set point as dictated by an uncontrollable variable

it would be a total of 10 psi (6+4). However, preact device throttles air flow to bellows *C* which retards follow-up motion of nozzle *D* and maintains slightly more clearance between nozzle and rising circular baffle *E*. This causes pressure rise to lag in capsular chamber *F*; its ball valve remains lower and output pressure to valve higher than dictated by proportional response alone so valve-closing action is accelerated.

Additional output pressure is the product of preact time and the rate of proportional-response pressure change, 4x1=4 psi. Therefore at the end of one minute output pressure is 14 instead of 10 psi. Pressure soon equalizes and controller comes to rest.

In a pneumatic-set control system the set pointer (control point) is adjusted by another instrument acted upon by an uncontrollable variable. For example, a temperature transmitter affected by outdoor temperature can vary the set point of an inside-temperature controller. The adjusting mechanism is shown by solid lines in Fig. 20 to differentiate it from the controller proper. In operation an increase in air pressure sent out from master instrument enters the chamber outside bellows *A* and forces pin *B* to the right. Parallelogram *C* transmits this movement to arm *D*, pivoted at *E*, swinging it upward to lift left end of lever *F*. Downward movement of right end turns floating gear *G* and moves set pointer to the left. If air pressure sent out by master instrument drops, reverse action takes place. Extent of set-pointer travel, per psi change in bellows pressure, is controlled by *H*.

Another supplementary control, secondary compensator in Fig. 21, corrects for fluctuations in the processing medium before it causes a serious upset. Through this device, throttling arm *A* feels instant changes in pressure beyond the control valve at *B*. Assume that controlled temperature or pressure increases and uncoils control helix *C* slightly. This lowers right-hand end of throttling arm to reduce air discharge from nozzle *D* and increase the pressure outside pilot bellows *E*. Its stem moves up and lifts ball valve from its seat to increase air pressure inside inner bellows, to valve diaphragm and primary compensator *F*.

Immediate effect is that valve starts moving and compensator *F* tends to straighten slightly and move point *G* downward. As lever *H* pivots at *I* this movement raises left-hand end of throttling arm away from nozzle *D* to proportion the air output according to the change in the variable. Lower pressure beyond the control valve at point *B* permits secondary compensator to coil slightly, raise point *I* (pivot of lever *H*) and assist in raising left end of throttling arm. After controller is at equilibrium, secondary compensator detects and corrects for pressure changes at *B*.

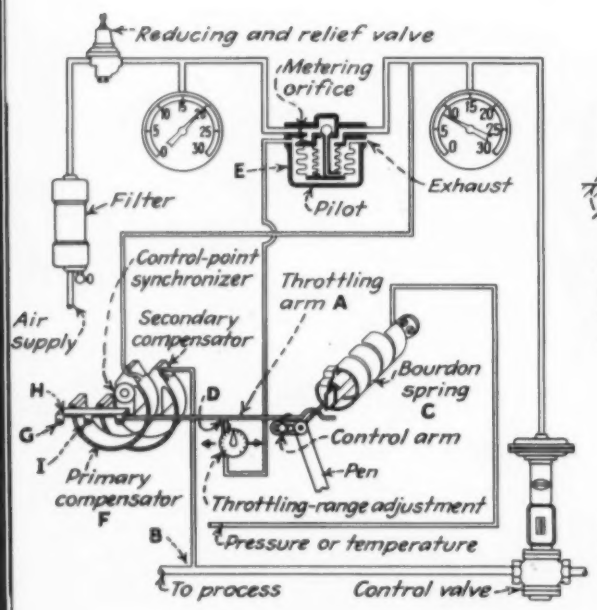
Controllers so far discussed do not take into account the time element, which is important in some processes. This requires an independent instrument (cycle controller or program clock) which, when connected into the control circuit, accurately times the application of heat, cold or other required services. In this device, Fig. 22, a clock mechanism (usually synchronous-motor driven) rotates a shaft carrying a series of adjustable cams that operate electric switches or air valves to control supply.

Clocks are available that run continuously in one direction, or that operate in one direction for half the cycle, then reverse and stop at end of second half. Some timers repeat either immediately or after a predetermined interval while others must be manually reset after each operation. Simplest use is to turn on building heat and admit the steam in short cycles to eliminate prolonged boiler overload. For cooking or press work these timers shut off the steam, relieve the pressure, and admit and shut off the cooling water.

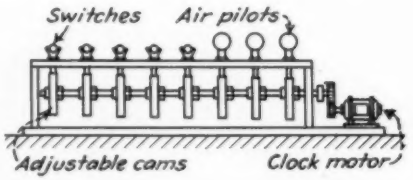
Pneumatic controllers need a supply of clean, dry air because moisture, oil and dirt plug the small orifices. If no other source is available install a compressing unit, adequate in size and complete with intake filter, cooling unit, moisture trap and receiver. Supply the cooler with chilled water if necessary so the air will be at a lower temperature than it will encounter in the distribution lines; this eliminates any possibility of moisture condensing out.

ACKNOWLEDGMENTS

For material used in preparing this section POWER is indebted to Alco Valve Co; ASME; Atlas Valve Co; Automatic Control Co; Bailey Meter Co; Black Sivalls & Bryson; The Bristol Co; The Brown Instrument Co; A W Cash Co; Clifford Mfg Co; Cochrane Corp; Crane Co; Crosby Steam Gage & Valve Co; Davis Regulator Co; Detroit Lubricator Co; F W Dwyer Mfg Co; Fedders Mfg Co; Fisher Governor Co; Foster Engineering Co; The Foxboro Co; The Fulton-Sylphon Co; General Controls Co; General Electric Co; Grove Regulator Co; Hagan Corp; Hammel-Dahl Co; The Hays Corp; Hoffman Specialty Co; Johnson Service Co; Kieley & Mueller Inc; Leeds & Northrup Co; Leslie Co; Linde Air Products Co; Jas P Marsh Corp; Mason-Neilan Regulator Co; The McAlear Mfg Co; The Mercoid Corp; Mueller Co; Natural Gas Equipment, Inc; Penn Electric Switch Co; The Powers Regulator Co; The Pyrometer Instrument Co; Republic Flow Meters Co; Sarco Co Inc; The C E Squires Co; Sterling Inc; Strong, Carlisle & Hammond Co; The Swartwout Co; C J Tagliabue Mfg Co; Taylor Instrument Cos; Tenny Engineering Co; Victor Equipment Co; Warren Webster Co; Watts Regulator Co; Wheelco Instruments Co; White-Rodgers Electric Co.



21 *(left)* **Secondary compensator corrects for fluctuations in processing medium before any trouble occurs**



22 A cycle controller driven by an electric clock motor introduces the timing feature which is often important. It starts and stops the process

Chemical Exposition Highlights For the Power Engineer

► MANY ITEMS EXHIBITED at the Chemical Exposition in Grand Central Palace, New York, Feb 25 to Mar 2, were developed during the war years and although full achievements were not divulged, displays portrayed many practicable solutions for plant problems.

The American Chemical Society's atomic-power exhibit told a picture story of the achievement of 400,000 persons who worked on the Manhattan Project. A series of panels unfolded the steps that show the many intricate processes to separate and concentrate U-235. Although many uranium compounds were displayed, some were not shown for personal safety and others were absent for national security reasons. A large animated panel illustrated the action of nuclear fission and chain reaction.

Other exhibits ranged from new consumer products to machines, power equipment and instruments to manufacture the merchandise. There were many examples of special structural and protective materials in the raw and fabricated form used to construct chemical apparatus. Pyrex, porcelain and silica pipe are now erected with about the same ease as metal; upset ends and metal flanges make a tight

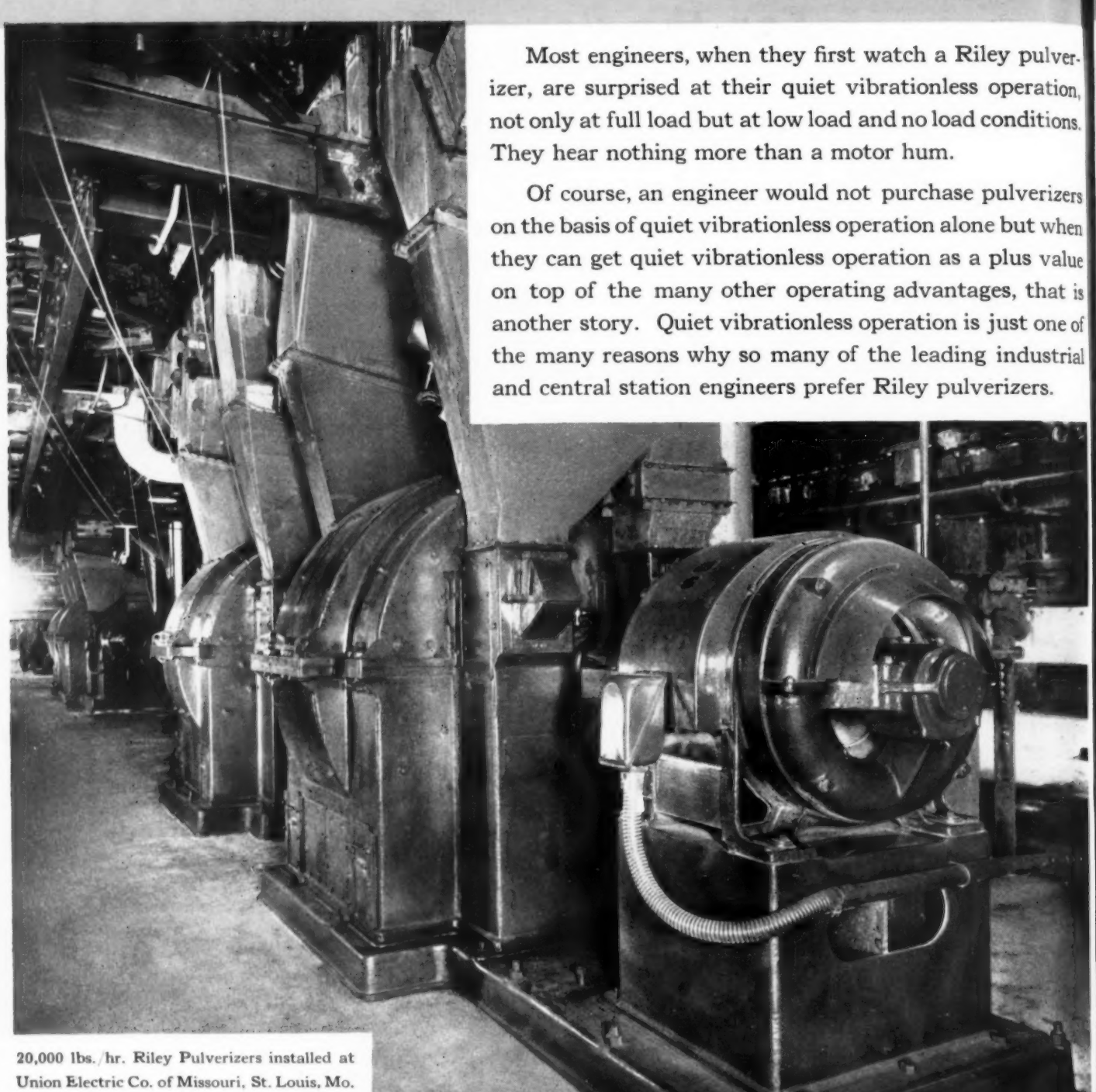
(*Continued on page* 98)

Electronic flowmeter with controller unit (above) measures and regulates flows as low as several drops a minute for mixing and titration. Exhibit included other special meters

Humidity recorder (left, center foreground) has a series of gold-wire coils to detect moisture content of the air. Full range, of 0 to 100% relative humidity, requires eight coils

Pyrometers and gas analyzers (below) both for recording and indicating were widely exhibited. Left: Silica pipe and vessels are for high-temperature and corrosive products

You'll be pleased with the Vibrationless



Most engineers, when they first watch a Riley pulverizer, are surprised at their quiet vibrationless operation, not only at full load but at low load and no load conditions. They hear nothing more than a motor hum.

Of course, an engineer would not purchase pulverizers on the basis of quiet vibrationless operation alone but when they can get quiet vibrationless operation as a plus value on top of the many other operating advantages, that is another story. Quiet vibrationless operation is just one of the many reasons why so many of the leading industrial and central station engineers prefer Riley pulverizers.

20,000 lbs./hr. Riley Pulverizers installed at Union Electric Co. of Missouri, St. Louis, Mo.

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It will pay you to visit modern Riley Installations

Quiet Operation of Riley Pulverizers

in addition to these operating advantages

Dependability

The dependability of Riley Pulverizers has been thoroughly established by their performance in hundreds of plants during the past twenty years. Plant after plant has operated Riley Pulverizers for years without forced outage because of pulverizer performance.

Explosion Proof

There has never been an explosion in a Riley Pulverizer. The velocity of coal travel through the pulverizer is faster than the speed of flame propagation, eliminating the possibility of an explosion.

Sustained Fineness of Pulverization

Because of the operating characteristics of Riley Pulverizers, wear of pulverizing parts has but small effect on fineness of pulverization, consequently fineness is maintained at a satisfactory degree throughout the life of the pulverizing elements.

Flexibility—Wide Load Range

As change in coal feed gives instantaneous corresponding change in pulverized coal output—there is no lag with Riley Pulverizers—rapidly and widely fluctuating loads are efficiently and easily carried.

Ability to Carry Low Loads

At extremely low loads the primary air supplied by Riley Pulverizers is not in excess of that required for efficient combustion, consequently low loads are easily carried. Load ranges of 10 to 1 are satisfactorily carried at many Riley installations.

Low Maintenance

Because of its rugged construction, the use of special alloy castings and employment of attrition in the pulverizing process, maintenance of Riley Pulverizers is low.

Parts Easily Renewed

All parts of Riley Pulverizers are easily and quickly renewed. Parts are all small in size and weight. A complete replacement of parts can be easily made in less than a day. Short period of outage is required for maintenance.

Low Cost of Lubrication

All bearings are outside the pulverizer housing where they are readily accessible and not subject to heat. There are no seals requiring grease from pressure guns. Lubrication costs are negligible, only small amounts of oil and grease being required.

Low Power Consumption

The use of two different principles of pulverization gives low power consumption at all loads. As no load power is extremely low with Riley Pulverizers, power consumption at reduced loads is unusually low.

High Primary Air Temperatures

There is no necessity of limiting primary air temperatures as a precaution against fire or explosion. High temperatures cause no lubrication problem. It is not necessary to install expensive control equipment to limit primary air temperatures.

Ability to Handle Wet Coals

With Riley Pulverizers, coal is pulverized in complete suspension and not between two surfaces, preventing packing of the coal and affording the most efficient drying effect from the air passing through the pulverizer.

Ease of Lighting

Because of the use of a small percentage of primary air, a rich and readily lighted mixture of air and coal is obtained which, together with the uniform distribution of coal from Riley Burners, makes lighting easy and gives a stable flame at low loads.

Ease of Regulation

There are but two adjustments to make with change in steam load—the coal feed to the pulverizers and the air supply to the burners. Automatic control can be readily and economically applied. Primary air temperatures need not be controlled.

Small Space Required

Due to the distinctive principle of pulverization employed with Riley Pulverizers, comparatively small space is required for their installation, both as to head room and floor area.

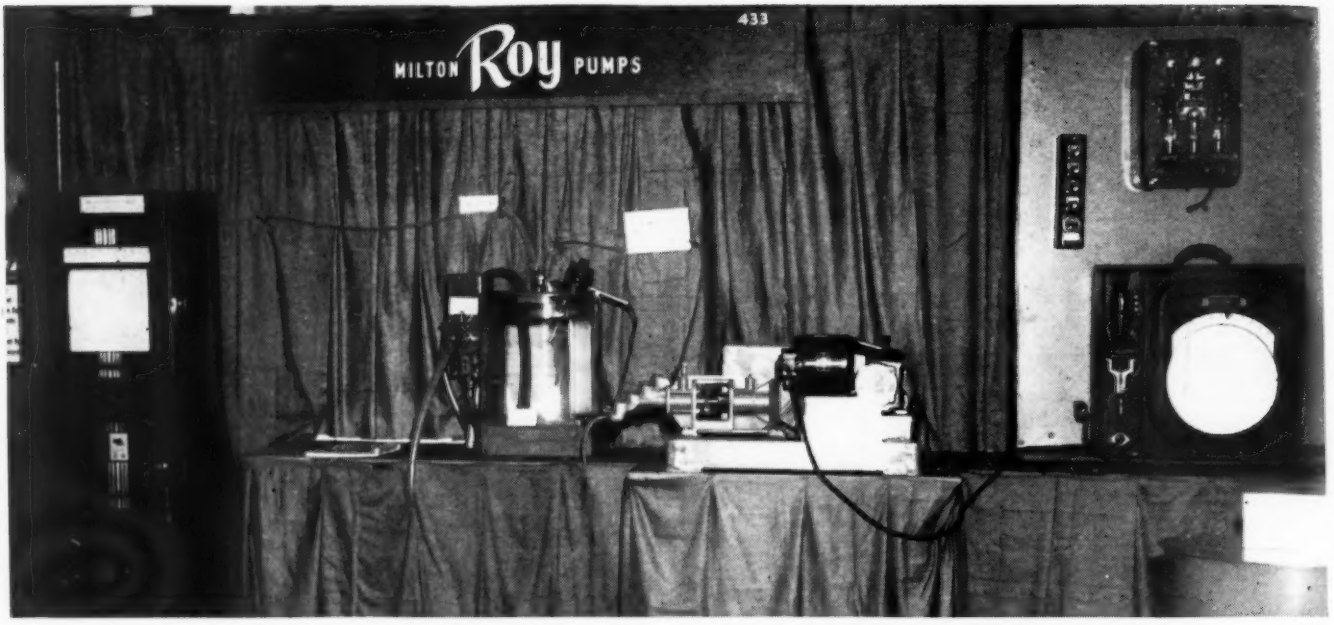
Minimum Foundations

Massive deep foundations are not required with Riley Pulverziers due to their vibrationless quiet operation. When considering the cost of pulverizers, cost of foundations required should be given consideration.

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

before purchasing Boiler or Fuel Burning Equipment



To maintain pH, the pH unit (left) adjusts proportioning pump stroke; rate-of-flow unit (right) adjusts pump speed

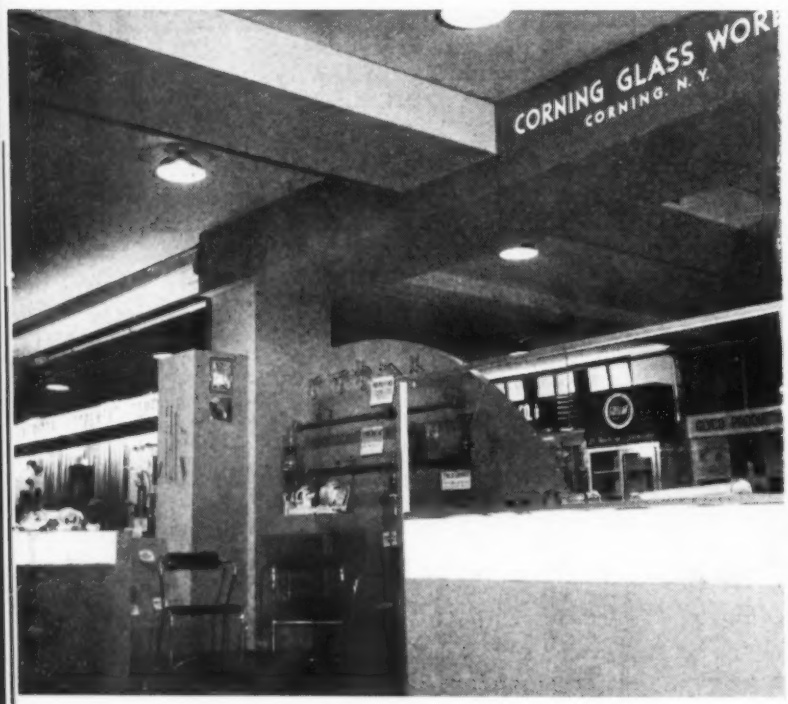
joint. Chlorinated paraffin resins, a fire retardent to coat canvas and camouflage netting for the armed forces, will soon fireproof drapes, curtains and tents.

An electronic flowmeter now measures flows under 10 cc per minute, and when coupled with a controller the combined instrument feeds liquids at the rate of a dripping faucet. Another device proportions the flow of two or more fluids in such a way that the streams remain in constant proportion regardless of variations in total flow. A pH controller feeds acid or alkali solution to maintain correct effluent pH. A total-flow element controls proportioning-pump speed and pH element regulates pump stroke.

Specialized devices exhibited included a full line of valves in stainless steel, pure nickel, monel, four types of Hastelloy and pure silver. The new nickel-base Hastelloys, which combine high strength with resistance to chemical corrosion, helped to make possible successful achievements in turbo-superchargers, jet-propulsion engines and gas turbines.

Laminated metals in sheet, wire and tube form now provide the necessary characteristics of the more precious metals at lower cost for handling corrosive materials.

Instruments displayed included a carbon-monoxide device that measures even a trace of the gas, a humidity indicator and recorder, and thermal-conductivity gas analyzer. A weather simulator reproduces temperature and humidity conditions like those in any climate and serves for testing the action on export products.



Pyrex piping with the ends fused into clamping shoulders for flanged joints transports many food and corrosive products

Pressure regulators, balanced single-seat valve and combination pressure-temperature unit feature this valve display

LOAN TO BRITAIN

. . . *Investment in World Economic Unity*

CONGRESS should give swift and confident approval to the proposed loan to Great Britain.

Few other issues of foreign policy in the present troubled world lend themselves to such clear appraisal of where our National interest lies.

In simplest terms, the question is whether we should extend to Great Britain a credit of $3¾ billions (plus $650 millions in payment for lend-lease balances) in return for her promise to repay principal with interest over a fifty year period starting at the end of 1951, and her pledge to give the fullest possible support to the kind of world trading system which it is the declared policy of both the United States and the United Nations Organization to promote.

We Can Afford to Make It

The sum we hazard is not inconsiderable, but financial risks have meaning only when related to resources. The line of credit provided by the loan will amount, at most, to a claim on 2/5 of 1 per cent of our gross output for the five to six year period over which it may be used. The interest rate charged, while moderate, is higher than our Treasury is paying upon current borrowings. The risk entailed is well within our resources as a creditor. In the considered judgment of the American and British technical experts who thrashed through the intricate accounting for three painful months, the amount and terms offered will suffice to allow Britain, under rigid austerity, to relax her system of foreign trade restrictions, and to expand exports sufficiently to pay her debt commitments.

Against the considered risks of extending the loan, there must be weighed the certain costs of refusing it. Without the loan, Britain has no recourse but to maintain and extend the system of bloc trading which she adopted under stress of world depression and world war. If that is the route Britain follows, she will carry with her a large part of the sterling area countries – all British Commonwealth and Empire countries (except Newfoundland and Canada) plus Egypt, Iraq, and Iceland—and many of the nations with which the United Kingdom has payment agreements (Argentina, Bolivia, Brazil, Chile, Paraguay, Peru, Uruguay, Belgium, Czechoslovakia, Denmark, Finland, France, Netherlands, Norway, Portugal, Spain, Sweden, and Turkey).

Altogether, the United Kingdom's orbit accounts for more than half of the world's imports and exports combined. It likewise is crucial to the trade of the United States. In the years immediately preceding the war, the sterling area and payment-agreement countries provided just under one-half of both the import and export trade of this country.

Russia, of course, will continue to conduct her foreign commerce exclusively upon a state-trading basis. Before the war, the Soviet Union transacted only a little more than 1 per cent of foreign trade business, but its future sphere of influence will be large—conceivably embracing as much as 30 per cent of total international trade.

We Cannot Afford to Refuse It

If the weight of British influence in foreign trade is thrown toward the Russian pattern rather than toward ours, it is apparent that bloc trading, with all of is supporting devices—bilateral deals, exchange controls, import and export quotas, subsidies, currency manipulations and the like—will be the prevailing pattern for foreign transactions.

In self-protection, the United States would have no alternative but to conform to the dominant pattern. We should be forced to form our own bloc, and to enter into active economic warfare in bidding for trade concessions against the offers of our rivals. How well we would do this is problematical. To the game we would bring the largest economic potential in the world. But our handicaps would be equally impressive.

First, under a system in which political and economic motivations are inextricably fused, a democratic nation, and particularly one with a tradition of freedom in its domestic enterprise, would operate at a great disadvantage. We should inevitably be driven toward more and more government control of our entire economy.

Second, with a pattern of foreign trade in which our exports habitually are greater than our imports, our bargaining position in international trade is much weaker than our over-all economic strength would suggest. Under state-controlled trading we should still find it difficult to compete successfully without resort to loans, and under these conditions our loans would be supporting a system alien to our choice and interest.

Third, under a regimented system which made economic decisions subservient to political considerations, it is virtually certain that the volume of world trade would shrink. That was the clear experience of the nineteen-thirties. Thus, the

standard of living in the United States would suffer in common with all others, and we would be forced into a particularly drastic curtailment of certain war-expanded segments of our economy, at the very time when a large portion of the world is most in need of the products they can produce.

Weighing the Alternative Costs

In the years immediately ahead it is certain that from two-thirds to three-quarters of all international trade will be transacted either in pounds or dollars. If both circuits are linked in a determined effort to restore competitive world markets, to which buyers and sellers alike have access without discrimination, that will be the dominant system of foreign trade. If the sterling group with its satellites organizes a closed grid, our exclusive effort cannot preserve the trade pattern that we believe offers most to us and to the world.

No one can accurately measure the costs to the United States of refusing the loan and accepting the consequences. But unquestionably they would dwarf to insignificance the sum risked in the proposed credit. We would lose through the shrinkage of our trade, through the wrench of violent readjustments in our production patterns, and eventually through the curtailment of our over-all output below what it would be under an open rather than a closed system. We would lose heavily in economic liberty under a procedure that can be followed with success only by a close regimentation of production as well as trade.

Most of all, we would lose in prestige, through demonstrating that we are still unprepared to exercise a world leadership to which our giant stature as the possessor of almost half of the world's economic capacity entitles us. Once again we would be exhibiting to the world political feet of clay supporting an economic frame of heroic proportions.

It Is Far from a "Soft" Bargain

There has been some disposition in this country to regard the loan to Britain as a somewhat "soft" and generally unprecedented transaction that smacks of charity. This is the sheerest nonsense.

In the first place, the kind of economic system we want has never functioned and cannot operate now without a lender. For many decades prior to World War I Great Britain filled the creditor role. In 1913 her foreign investments totaled $19 billions, and she not only made such transactions pay, but they proved her salvation through two grim wars. Her credits helped in the industrial development of a large segment of the world, including the United States. Of all the nations in the world, only the United States can assume now the mantle which Britain no longer can support.

In the second place, the terms of our proposed loan to the United Kingdom are far from easy. Britain put a substantially greater proportion of her relatively meager resources into the war than we did, and dissipated a large share of her foreign holdings in the process while accumulating an outside debt of crushing magnitude. On a per capita basis her internal debt is greater than ours. Many Britons feel that our proposed loan is too small, and its terms too rigorous. If the amount proves to be inadequate, we shall have to consider supplemental aid at a later date. But the majority believe that the present offer gives a fighting chance to restore the system of world trade that we and they both want, and upon which the World Bank, the Monetary Fund, and the International Trade Organization under United Nations aegis are based. It is certain that without our loan all of this will go by the board.

In the third place, our proposed loan is far from being without precedent. Canada, which is linked by far closer economic ties to us than to the Empire, already has provided for a loan to Britain of $1,200,000,000. This amounts to almost a third of what we propose to lend, although Canada's population is less than 10 per cent, and her income is little more than 5 per cent of ours.

Shall the United States Lead or Follow?

The way to exercise leadership is to lead. Nothing could be more futile than to go half way toward establishing the economic order for which we stand, and then withhold the crucial measure that will make it work. Failure to approve the loan to Britain will be a clear default of leadership. Failure to approve it promptly will dissipate its effectiveness.

It has been officially stated that the British loan is a unique case that will establish no precedents for further credits to other nations. It is exceptional in its importance to our aim. But if the United States expects to make its economic program the dominant one for world trade, it must continue to exercise the creditor function without which that program cannot persist.

The most that we should ask is that future loan transactions be scrutinized as was this one to see that they offer comparable security and comparable return in support of the program for which we stand.

For the loan to Britain, it can be said that never before has one nation had an opportunity to gain so much at so little risk as has the United States in this uniquely decisive case.

President, McGraw-Hill Publishing Co., Inc.

Old Condenser Tubes Get New Lease On Life

Frank F Fisher, The Detroit Edison Co, tells how the tube expander used in making metal-to-metal joints helps to stop leakage in old-type packed tube joints. Economy is effected in maintenance labor, tube renewal and outage time

▶ DURING THE PAST DECADE there has been practically a complete change in the manner of sealing condenser tubes in tube sheets. Earlier methods used soft packings and fiber rings held in a packed joint by a threaded ferrule. But higher steam pressures and temperatures required greater vigilance in the design of power-plant equipment, and the prevention of boiler feedwater contamination from leaking condenser-tube joints became very important. This is why a metal-to-metal expanded or rolled joint has largely supplanted the packed condenser-tube joint.

The tool* used in making this rolled joint can also correct some of the faults of the older packed tube joint at a minimum cost. Besides completely rejuvenating leaking packed joints many tubes that would ordinarily be thrown on the scrap pile have been restored to usefulness.

During the rebuilding of several large turbine-generators in power plants on the Detroit River it was decided to re-use as many of the tubes in their condensers as practicable. These tubes were 1 in. dia, 18 BWG, 24 ft long, and made of Admiralty metal. All had been packed at both ends with woven cotton packing held between two fiber rings and fixed in place by the usual threaded ferrule, as shown in Fig. 1.

Condenser tubes in plants using Great Lakes water give practically unlimited service when made from Admiralty metal because of the absence of water impurities. Old tubes can be re-used provided their ends are in serviceable condition. To obtain leak-free packed tube joints the tube ends in the joint must be smooth and cylindrical. A large number of the condenser tubes mentioned did not meet this requirement; many, in service for 15 years or more, had evidently been subject to vibration. This had caused a slight tube movement in the packing and worn off some of the tube metal. Extent of wear varied from a surface polishing to deep cutting. Fig. 2, *A* shows this condition in somewhat exaggerated form.

On many other tubes, probably to stop recurring leaks, repeated ferrule tightening had compressed the packing to such an extent that it forced the tube wall to bow inward causing a constriction. This occurred sometimes part way, often entirely around the tube; Fig 2, *B* and *C* show sections of these deformed ends. Sometimes this condition might also be caused by improper tool use in making the joints during initial condenser installation. Tube joints in the condition shown will probably not remain tight very long in service. Neither can they function as intended, that is, allow the tube to slide in the joint without leakage in compensating for variations in distance between tube sheets during temperature changes.

Necked tubes interfere with condenser cleaning. When plugs are shot through the tubes, they lodge at the necked portions, shutting off the water flow, and form a gathering place for more plugs.

Tube ends in these conditions could not be tolerated in the rebuilt condensers. How to reclaim the majority of the 50,000 tubes in lots of 8000 became the problem. Reclaiming had to be done at various intervals and at different locations. The method of driving a suitably shaped and sized pin into the tube end was out of the question because of the time consumed; furthermore the results are usually unsatisfactory. Other methods were considered and dropped because they were either impracticable or too expensive.

The final solution consisted of clamping the tube end in a die of correct diameter and rolling to the proper inside diameter with an ordinary tube expander. A sketch of the die is shown in Fig. 3. The split die was made from two pieces of 2x5-in. tool steel and fitted with four short dowels for aligning. The assembled pieces were bored to the nominal outside tube diameter, 1 in. in this case. With the bore-hole axis horizontal, they were then fastened to the jaws of a vise so that opening and closing it also opened and closed the die. Any tube end that was out of shape, flattened or bent was quickly drawn into shape by clamping it in the die. Applying an expander to the tube interior, while it was clamped, reshaped and restored the original size of the end.

Expander Arrangement

A self-feeding, so-called "parallel" expander was used because a tube end expanded by it is almost cylindrical. The stop affixed to the taper mandrel in Fig. 1 limits the extent of the insertion of the expander into the tube, in this way controlling the internal diameter of all the ends being rolled. Any internal-tube diameter within the capacity of the tool may be rolled by a simple change in stop location. With an end clamped in the die and the stop set to roll only the actual inside-tube diameter, the expander simply corrects any tube-end deformation with a

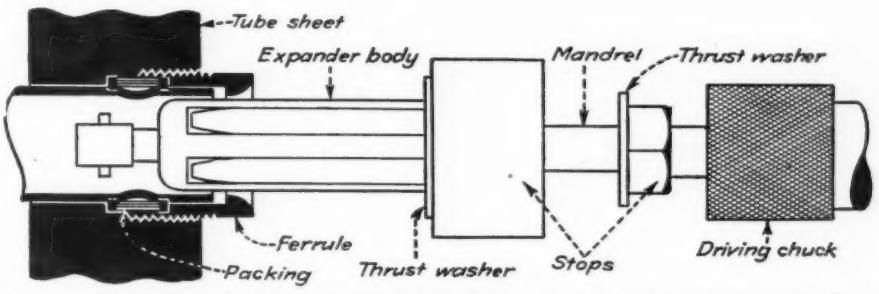


Fig. 1—"Parallel" self-feeding expander being inserted into packed tube joint to straighten tube by removing necking. Tube is not expanded to compress packing

* For tool description see F F Fisher and E T Cope, "Automatic Uniform Rolling-in of Small Tubes," *Transactions, ASME*, Vol 65, pp 53–60.

minimum of the necessary cold working.

However, cold working may be increased safely without injury to the tube metal. It may be of advantage to cold work the tube end slightly because a hardened wall would better resist the packing pressure and wear. Advantage was taken of this in reclaiming worn tube ends by rolling them to a larger than nominal inside diameter. As the dies prevent any tube-end external enlargement the metal displaced by the expander roller action tends to flow to the worn section and fill it out to fit the die contour. Many tubes that otherwise would have been discarded were salvaged in this manner.

To speed the work and reduce handling costs, two vises each having a die attached were used. These were spaced the correct distance apart to accommodate both ends of a tube at the same time. As most tubes needed attention on either one or both ends, all tubes regardless of their condition, were processed in the same way. Two men handled the tubes from one pile to the dies, rolled and inspected the ends and passed the tubes to another pile at the rate of about 500 per 8-hr day. Rejected tubes did not exceed 0.5% of all those processed. Some were rejected for causes other than bad ends. This is a remarkable record considering the original condition of the tube ends. These reclaimed tubes have now been in service for a number of years and without exception have proved equal in performance to new tubes in all respects.

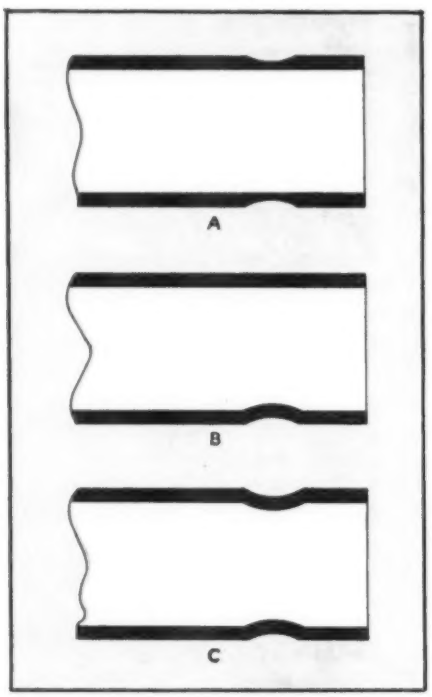


Fig. 2—Tube cross-sections show nature of damage after service. A: tube metal partly worn away by vibration; B: partial necking; C: complete necking

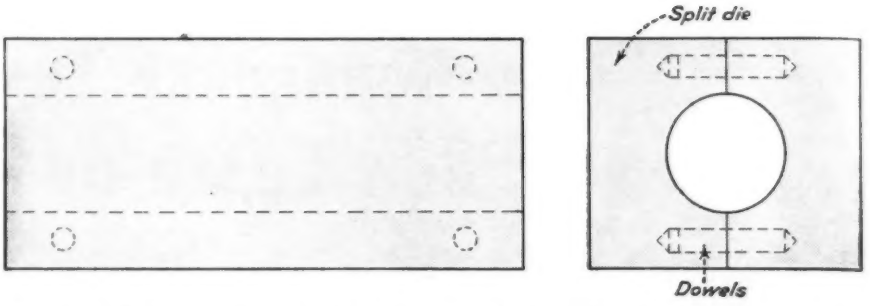


Fig. 3—Split die for straightening and reshaping damaged tube ends. The die halves are mounted between vise jaws, opening and closing with vise for fast use

It might be thought that motor-driven expanders would speed up the job. This is not the case, because they take too long to operate. Tube-end expanding requires less time than any of the other operations involved. Driving the mandrel manually through a crank handle is preferable as it makes the expander light in weight and easy to handle.

Torpedo-Shaped Rollers

The entrance end of the rollers is not square, but was finished with a large radius to prevent formation of cuts and shoulders on the tube interior. Although the roller was proposed and first used in this country (see paper by F F Fisher and E T Cope, *Transactions, ASME*, Vol 57, pp 145–152) the shape of its end was christened in England. A recent paper dealing with leaky tube joints in two high-pressure boilers at Battersea Station, London, aptly describes these ends as "torpedo shaped."

Expanders can also restore tightness to leaky tube joints in condensers. Demonstrated repeatedly during the past five years, expander use for this purpose originated in a powerhouse having three 50,000-kw turbine-generators and surface condensers. For reasons never definitely established, one of the condensers after a few years' service required continuous maintenance because of leaks at the packed end of the condenser tubes. The other ends, which had been originally rolled-in, presented no problem. This leakage finally became so serious that treatment had to be drastic. Repacking of all tube joints with a different type of packing was thought to be the right remedy, although the original packing had given excellent results in the other two condensers.

To pack a tube joint with the tube in place is a very simple job, but to replace the old packing under like circumstances introduces a serious difficulty. The best tools available are not good enough and the packing cannot be cleaned out thoroughly. It is cheaper and better to remove the tubes entirely. This could be done as the expanded end was rolled lightly for a length of $\frac{3}{4}$ in. in a tube sheet 1.5 in. thick. Removing the tubes would also give an opportunity to recondition the packing end. However, to do all work necessary for such a job the 50,000-kw unit would have to be shut down five to six weeks. Such a long outage together with the labor and material would make this undertaking very costly.

Further inspection disclosed that a high percentage of the packed tube ends had constrictions that do not make for tight joints. In view of this, the tube joints were reconditioned during a week-end shutdown by means of the expanders instead of repacking the condenser. Results were better than anticipated. Besides yielding improved joint contact on a majority of the tubes, rolling also discloses the joints in which the ferrule needs tightening and those that have defects.

After repairing the leaky and defective joints with the aid of rolling, a few hours' job, the condenser had practically no leakage. More important is the fact that for the past five years it has continued to show a leakage rate equal to or better than its two companion condensers.

(*Continued on page* 138)

Atom-Bomb Refrigeration

The unusual development reported in "Nitrous-Oxide Meets Low-Temperature Refrigeration Requirements," June 1945 Power, p 69, was conducted for the Kellex Corp, and used in the gas-diffusion process in the atomic-bomb plant at Oak Ridge, Tenn. Official permission to reveal this interesting fact was recently granted.

Change in Steam-Process Needs Compels Water-Treatment Revisions

Added processes and load from another plant created a demand for a revamped water-treatment system. J P Warren, power superintendent, Velasco, Tex. plant, Dow Magnesium, winds up a series by detailing water-control methods and equipment

▶ WATER CONDITIONING, in keeping with war-dictated changes in our 130,000-kw power plant, underwent revisions and adaptations. Originally, under a straightforward magnesium production, almost 100% condensate return seemed possible so we felt that a 100,000-lb-per-hr softener for boiler makeup was adequate for such a light demand.

Later, excess steam capacity at Dow prompted the location of a 50,000-ton-per-year styrene plant adjacent to the magnesium plant. Addition of a 400,000-lb-per-hr softener, pumps and storage tank met makeup demands imposed by this new and increased load. Total steam load reached 500,000 lb per hr for process needs alone in addition to steam-generation requirements.

Process needs drew steam at various pressure levels, chiefly 400 and 250 psi, but for a while special oil-field boilers delivered 350-psi steam to process. Condensate return from all process sources enters a common storage tank for reuse. If, for any reason, returned condensate becomes contaminated, provisions at the gathering station and at the entry to the main storage tank automatically dump this rejected portion overboard.

Makeup for water losses incurred in power generation and process comes from the above mentioned hot-process water-softening plants by way of a storage-tank system that serves as a cushion against surges in operating demand. Pumps deliver this water to an open heater from which makeup pumps take their suction supply.

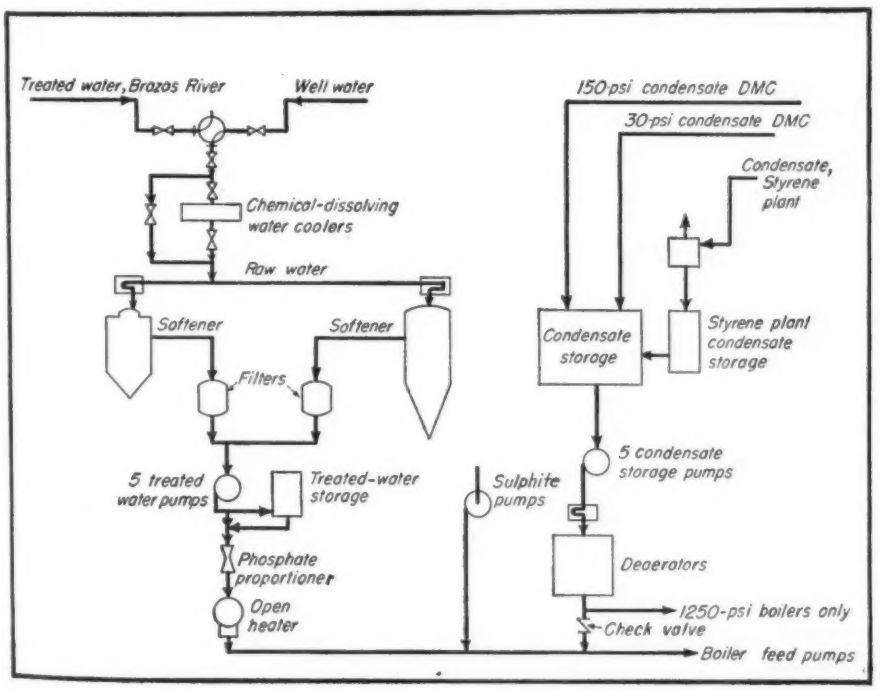
Raw water exists at two sources. At first well water from a depth of 150 ft formed the basis for water considerations so wells were drilled 250 ft deep. Later, additional raw water from the Brazos River met requirements of added process and power consumption. Water from either of these sources passes through softeners of the conventional lime-soda-ash process that reduce an initial total hardness of 160–175 ppm down to 10–17 ppm.

Since there are no evaporators, this treated water enters directly into the low-pressure boilers with facilities for combining with condensate in amounts depending upon the quantity of condensate in storage. Under heavy load, only treated water reaches the 250-psi boilers. Under all conditions, only condensate goes to 1250-psi units.

During a period in which oil-field boilers aided in supplying process steam, treated water was fed to these steam generators except when short-duration surges filled the condensate storage.

Water control for 1250-psi boilers receives closer attention than for low-pressure units. As a guarantee of directing only condensate to these high-pressure installations, a practice of (1) using treated water for 250-psi boilers and (2) in effect employing part of this low-pressure capacity as an evaporator makes possible ample condensate return. Such water aids materially in preventing scale formation and carryover.

Feeding softening chemicals directly to low-pressure boilers combats scale formation by producing a soft sludge. Sodium phosphate converts any scale-forming solids to soft, nonadherent sludge, which blowdown removes in large measure.

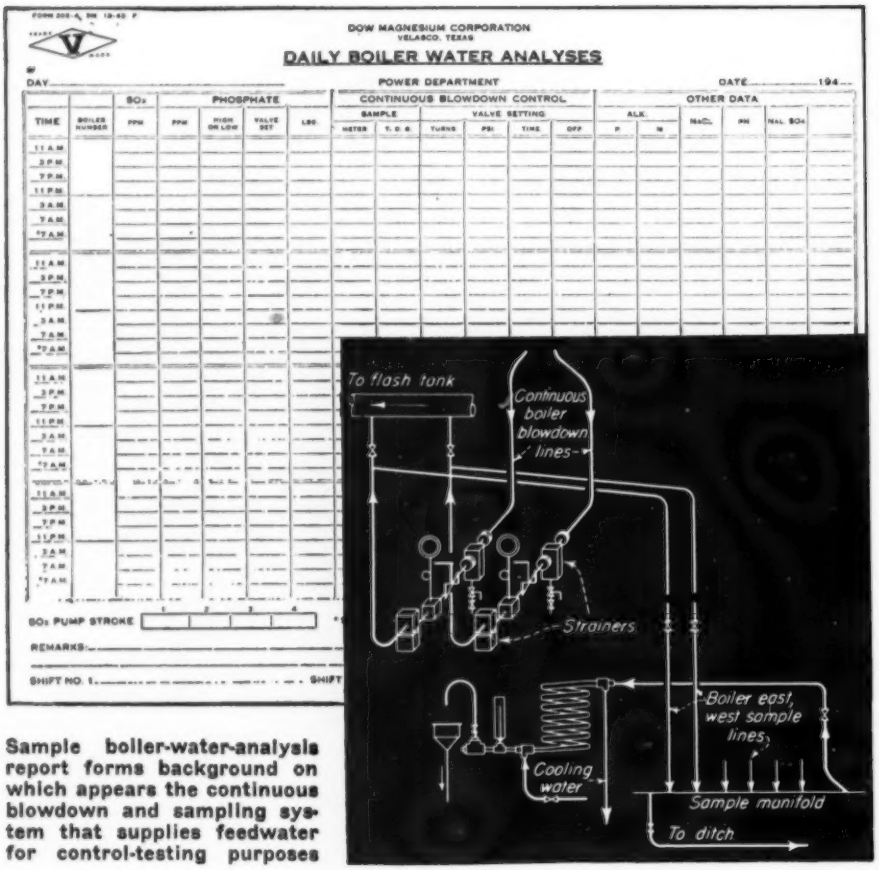


This flow diagram pictures the major equipment and their interrelation in the feedwater-treatment cycle at the Velasco, Texas, plant of the Dow Magnesium Corp

High-Pressure Boilers

Despite use of condensate and evaporated product of low-pressure units to prevent hardness in 1250-psi-boiler water, hardness still creeps in through condenser leakage or some condensate contamination. For this reason an excess soluble phosphate balance in the high-pressure boilers offsets scale formation.

Guarding against corrosion consists of controlling phosphate alkalinity by maintaining a pH of 10.5 and better. Curves established to guide operators help in holding this figure within limits. Monosodium phosphate, sodium hexametaphosphate, disodium and trisodium phosphate



Sample boiler-water-analysis report forms background on which appears the continuous blowdown and sampling system that supplies feedwater for control-testing purposes

provide pH control in these boilers.

To prevent scale formation, batch-mixing tanks, pumps and proportioners aid maintenance of a soluble phosphate of 40 to 80 ppm in boiler water. All tanks carry gages and calibration aids with necessary instructions. Inasmuch as 250-psi boilers use treated water, pH control requires little attention. Condensate reaching high-pressure boilers, however, contains free CO_2 so phosphate salts are introduced to maintain pH values. A further problem from oxygen creeping into closed systems compels the addition of a reducing agent. A balance of 10 to 20 ppm of sodium sulphite affords this protection.

Sulphite-treatment tanks, recirculating pumps and proportioners, in addition to feeding required chemicals for operating balances, help to lay up a boiler wet. Attainment of a 100-ppm sulphite in solution and sufficient trisodium phosphate, to reach a pH of 11.6 immediately after a boiler has stopped steaming, gives good boiler-surface protection. Upon cooling, additional water fed to the drum compensates for losses and keeps it filled to the vent overflow.

In operation a continuous blowdown or flow-control combination permits treating-plant operators to keep a close check on water conditioning. A sampling cooler operates continuously on blowdown with a conductivity cell and thermometer ahead of the sampler discharge.

Operating limits set by the feedwater consultant, S T Powell, and directed by H E Bacon, field engineer, appear in a manual containing graphs, drawings, tables and procedure for keeping water control within desired limits.

A system of hourly samples and records is carried on under a chemist's direction. Routine tests and treatment require one operator for each 8-hour shift. The plant chemist usually handles special tests such as ammonia and silica determinations in boiler water.

Control Blowdown Sampling

The continuous blowdown sampling cooler mentioned above operates through an arrangement of micrometer valves, orifices, pressure gages and shutoff valves on each individual blowdown line with all emptying into a manifold that vents into a 5-psi system. This flash steam delivers into a sedimentation tank the water and sludge being drained to the sewer.

Total solids in the 250-psi boiler blowdown, obtained with a conductivity meter, appear on a daily record. ASME standard recommendation for sulphate to carbonate ratios forms the operating guide for these 250-psi boilers. Both low- and high-pressure units employ embrittlement detectors. Phosphate salts to the complete exclusion of caustic supply alkalinity control.

This power plant has been in continuous operation 2½ years with no abnormal developments. The 250-psi steam generators have required an average amount of tube cleaning. Evaporators would have been desirable but their availability in wartime was limited and immediate production was most important.

Average Analyses of Water Entering Steam Cycle

Sample, ppm	*Well water*	*Raw Brazos River water*	*Raw water leaving lime-soda process*
pH	7.83	9.13	10.5
Ammonia	1.0	0.0	0.03
Phenolphthalein	0.0	15	28
Methyl orange	446	65	63
Total hardness	173	163	17
Calcium	28	27	2
Sodium and potassium	25	61	129
Bicarbonate	544	42	9
Hydroxyl	0	0	0
Chloride	184	135	109
Silicon dioxide	15	11	1 to 3
Sulphate	9	40	75
Magnesium	25	23	3
Carbonate	0.0	18	35

Operating Limits Set by Water Consultant

Sample, ppm	*Treated water*	*1250-psi boiler water*	*250-psi boiler water*
pH	.....	10.5 minimum	10.6 minimum
Total alkalinity	50–60	150 maximum	350 maximum
Total hardness	10–14		
Total carbonate	50–60		
Total solids	.....	1000 maximum	2000–3000
Excess lime	0–10		
Excess soda	40–50		
Sulphite	.....	10–20	10–20 low makeup 30–50 high makeup
Phosphate	.....	40–80	40–80
Silica	.....	10 maximum	30 maximum

Above: Table lists concentration levels set by the water consultants. Left: This table of water analyses shows the condition of the source waters before and after softening

THE OPERATING ENGINEER

George Edwards *Advisory Editor*

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS — ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Plant-Designed System Solves Forge-Shop Heating Problems

C J Lloyd, chief power engineer, tells how Wyman-Gordon Co controls the temperature in its forge shop so the operators throughout the open floor receive maximum year-round benefit

Fig. 1—Each morning Chief Engineer Lloyd checks outside-air temperature on the thermometer, mounted lower center, then adjusts air-duct temperature accordingly

▶ ADEQUATE HEAT AND VENTILATION in our Worcester, Mass., forge shop could not be maintained by simply installing radiators along the outside walls and opening the windows. With forge hammers and furnaces spaced throughout the shop, large quantities of air are needed at the right temperature in the right place to furnish the right heat and ventilation for the operators. We wanted a central distribution system that would provide a constant volume of heated air to each individual location. Temperature control by a single thermostat wasn't practicable because we had no representative place for its location. Therefore a remote control point, with a manually selected air-temperature regulation, was chosen as the best solution since it placed responsibility on one man who knew all the requirements, making adjustments accordingly.

Two Heaters Used

We heat the air in two systems that distribute hot air around the shop. One system circulates 120,000 cfm of air, which is divided between the outside-wall and center-aisle areas. The other circulates 70,000 cfm along the inside wall. As the systems are alike, the larger is described fully, with only references to the smaller. Cold air is drawn into a small room or penthouse on top of the boiler room. The incoming air passes through either or both of two sets of dampers, each of which is individually controlled, Fig. 2. One set, regulating the amount of air passing through the heaters, has so-called face dampers; the other set has bypass dampers only, which allow air to bypass the heaters. The

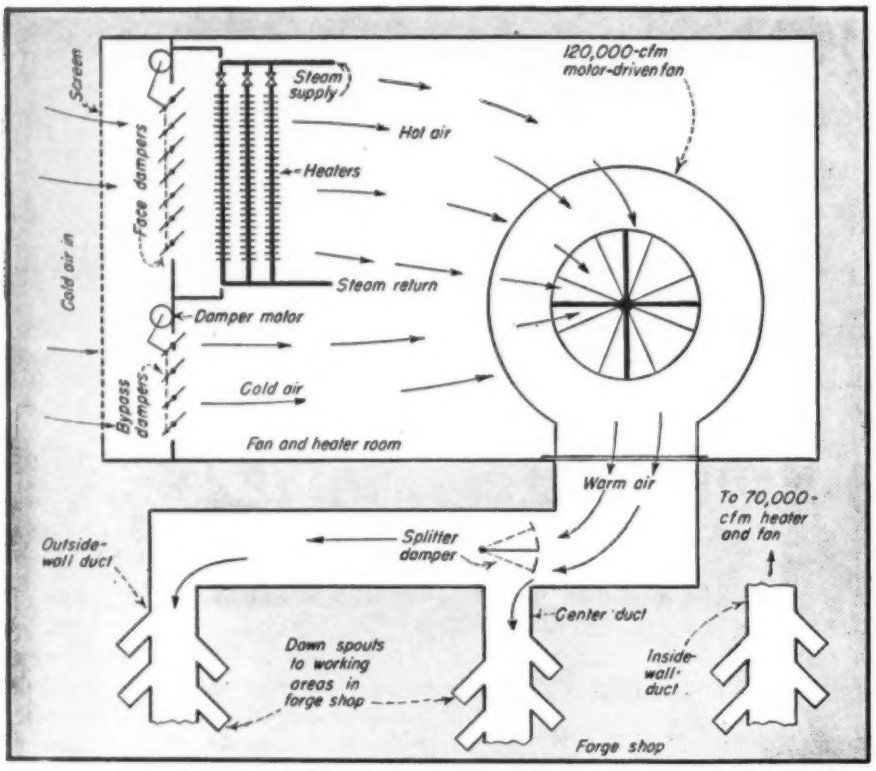


Fig 2—Hot-air distribution system shows location of heaters and dampers. Splitter damper regulates relative air flow to the outside wall and center sections

Fig. 3—Air duct at top center shows individual source of air to each location. Fresh air blown into center of working area gives maximum comfort to operators

larger system has 175 sq ft of face dampers and 88 sq ft of bypass dampers, while the smaller system has 103 and 50 sq ft.

Hot and cold air are mixed in the room before being blown into the discharge duct for transmission to the forge shop. Air temperature in the duct is regulated by a preset submaster temperature relay. This relay with the aid of a reverse-acting relay, Fig. 4 and 5, moves the face and bypass dampers open and closed to keep the temperature of the air constant by regulating the amount passing through and around the heaters. The main function of the reverse-acting relay is to close one set of dampers as the other opens. This insures against closing both sets simultaneously because the fan would have enough force to collapse the walls of the room if the intake were completely closed while the fan was running.

Shift Air By Seasons

During the winter months it is desirable to have a large volume of warm air circulated along the outside wall to compensate for opening of doors and heat lost through the walls. In the summer, however, the objective is to remove as much heat as possible from the center of the shop by circulating large volumes of cool air in this section. Accordingly, a damper was installed in the duct where the "Y" branches between the outside and center sections. This splitter-damper position is controlled from a proportioning switch on the control board. In winter about 75% of the hot air is routed along the outside-wall duct and 25% down the center of the shop. In summer these percentages are reversed and the larger volume of cool air is sent into the center where the heat from the furnace is more intense.

The setting of the submaster thermostat is adjusted manually at the control board. Each morning the outside temperature is checked from an indicating thermometer mounted on the control board and the air temperature in the duct adjusted accordingly, as in the table below. Each system has sufficient heater capacity to raise its volume of air to 110 F when the temperature outside is 0 F.

A schematic control diagram for the

Air-Temperature Selection

Outside temperature, F	*Air-duct temperature, F*
0 or less	95 or more
0 to 30	80
30 to 55	70
55 to 70	Shut off air and heat
70 and above	Admit cold air

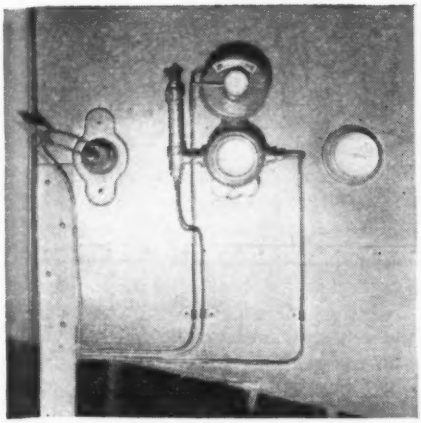


Fig 4—On the side of air duct below fan room is submaster temperature relay

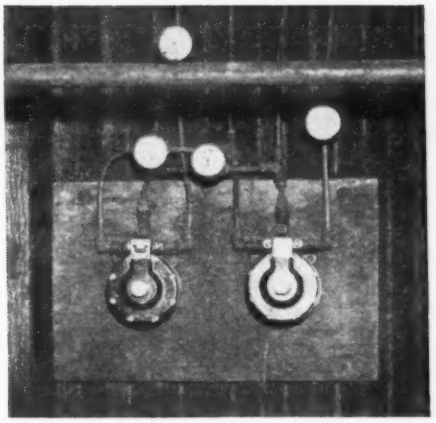


Fig. 5—Reverse-acting relays regulate position of the face and bypass dampers

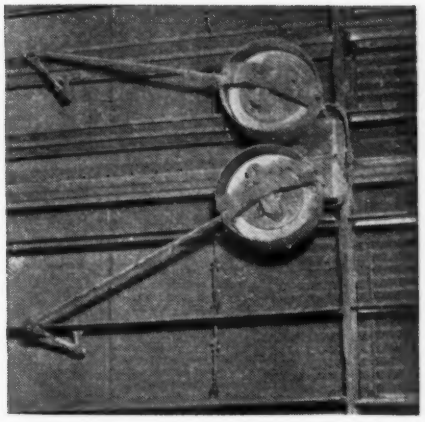


Fig. 6—Air-operated damper motors open and close face and bypass dampers

large system is shown in Fig. 7. Control of all devices is performed by 15-psi air pressure except the initiating air valve and motor starting contactor, which are electrically operated. To start the system, the operator depresses the start button on the control board. This pushbutton opens the electrically operated air valve and admits the 15-psi control air pressure to the control system. The pushbutton must be depressed until the control-system pressure reaches 5 psi, which is required to close the pressure switch that energizes the motor starter for the fan. An interlock on the fan starter completes the pushbutton circuit so the operator can remove his finger. About 30 seconds is required for pressure to build up and start the fan motor. A red light on the pushbutton indicates that the fan has started.

Air pressure that actuates the pressure switch is supplied through the balance relay in such a way that the same pressure which opens the face dampers through air-operated damper motors, Fig. 6, actuates the pressure switch. This is an interlock check to insure opening of face dampers before the fan starts to avoid pulling a vacuum on the fan room and collapsing the walls.

Air temperature in the duct is maintained at a set value by the submaster relay, shown in Fig. 4, mounted on the side of the duct just below the fan room. The temperature at which this regulator maintains the air is selected by the discharge air reset controller mounted on the control board. This controller is adjustable between 50 and 110 F. The actual air temperature is regulated by opening and closing the bypass and face dampers in front of heaters with steam-supply control for adjustment when outside temperature is not too low. When the system is shut down both the face and bypass dampers are normally closed because they act as shutoff as well as temperature-control dampers.

Although the steam valves are opened and closed by the temperature-control device as a secondary heat control to the dampers a selector is provided for open,

(*Continued on page* 138)

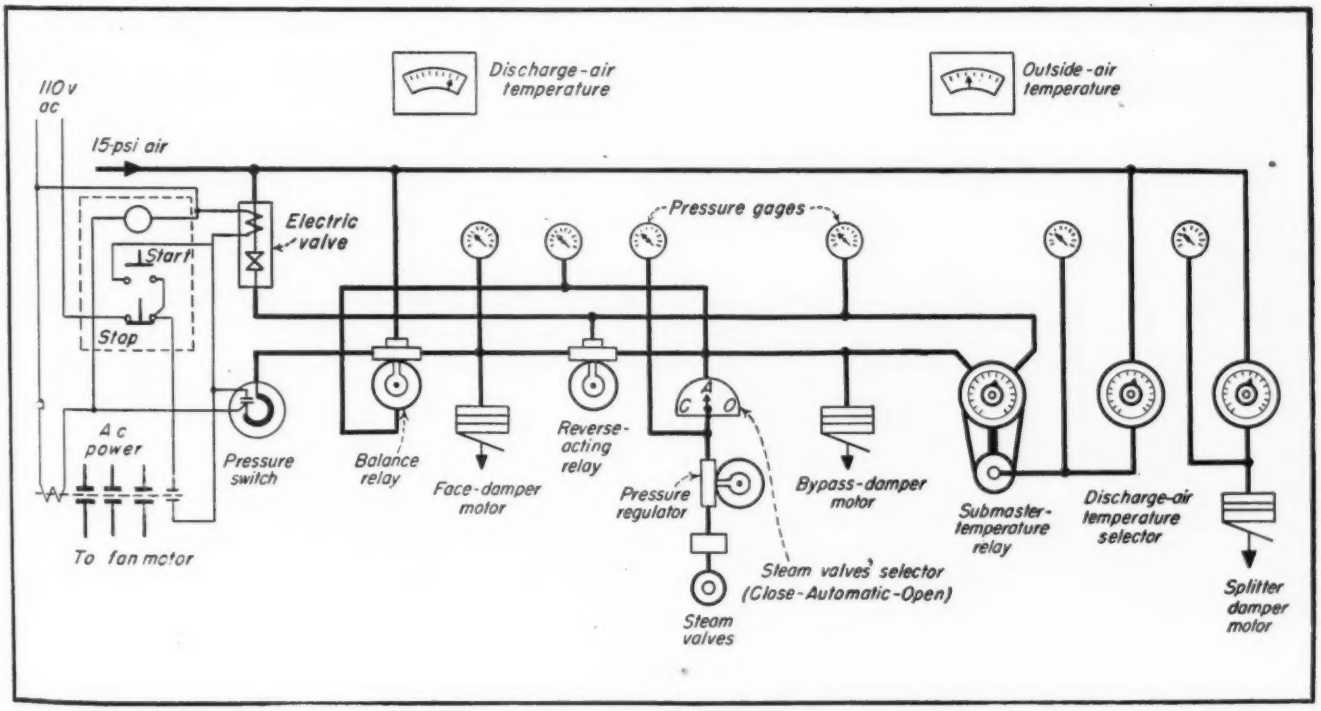
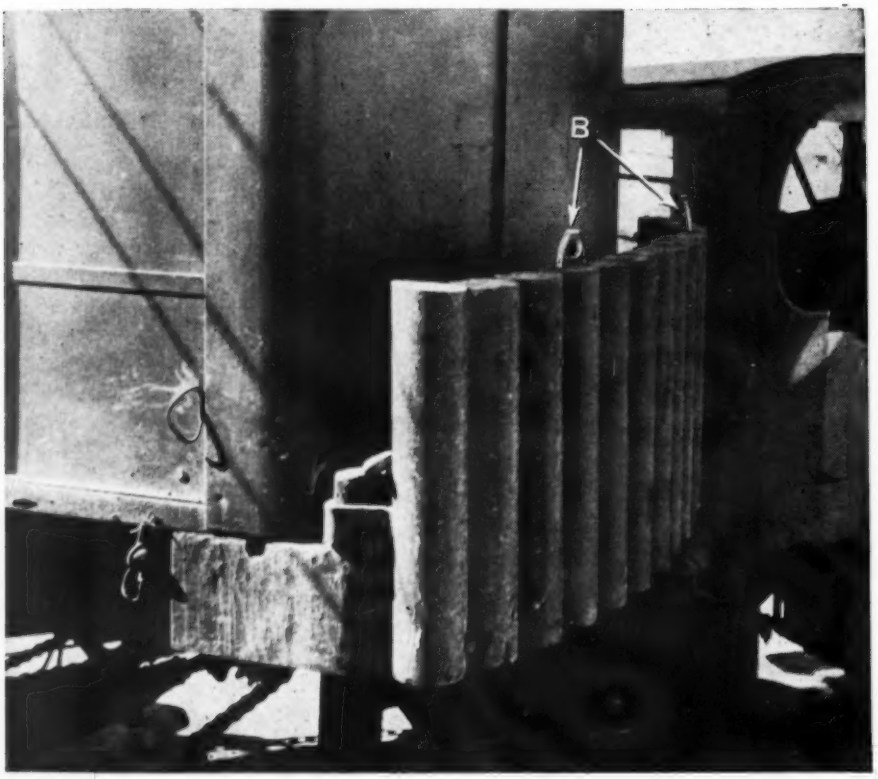


Fig. 7—Schematic diagram showing air-control system devices and their coordination with the electrically operated fan. Two duplicate systems control the operation of the heating equipment but for simplicity only one is shown

PRACTICAL AIDS TO OPERATION

Plant-Tested Methods and Ideas for Power Men



CAPACITY OF PORTABLE CRANE INCREASED

SHIFTING OF UNUSUALLY HEAVY LOADS such as boilers and power units was taxing the lifting capacity of the truck-mounted crane in one plant. The crane had ample power and a boom capable of lifting the heavier loads but it needed counterweights that could be quickly attached or removed. These had to be arranged so that they would not block free turning of the crane as it swung past the truck cab's rear. A compact row of 30-in. lengths of 6-in. round steel scrap welded together vertically side by side solved the problem, as in the photo. Made up in two groups of eight steel lengths each, the two weights hook over the regular counterweight casting at the rear of the crane housing. A lifting eye, *B*, welded to each weight simplifies its handling by another crane. These auxiliary weights, which may be attached or removed easily, have paid their original cost several times.

Pomona, Calif. G M WILSON

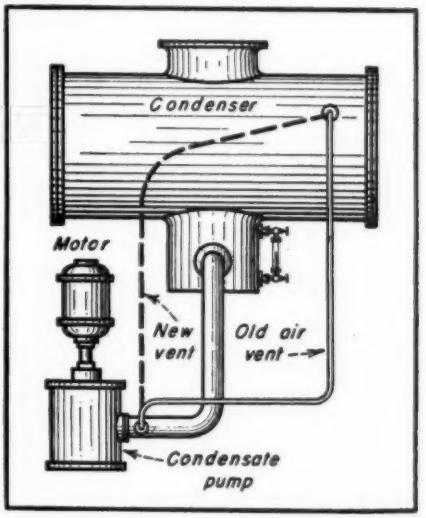
Hardwood Dust Caused Explosion

A HARDWOOD-WORKING PLANT processes much of its waste wood through a hog, after which it is ground and screened into several grades, including fine wood flour. As might be expected, much fine dust is always in the air inside the wood-processing building. In spite of a magnetic separator in the sawdust stream, tramp iron got into the wood grinder and the resultant sparks caused a disastrous explosion and fire.

About 50 heads opened in the 200-psi water sprinkler system but these failed to prevent serious damage. Four or five men in the grinding room were seriously burned. The whole plant was shut down for over a week, and the wood-processing department for over a month.

Experiments made when training fire-protection recruits in wood-working plants showed that fine pine sawdust was explosive when shaken through cheese cloth onto an open flame. Hardwood dust so treated was almost inert while cornstarch was highly explosive. In view of the explosion described the experiments with hardwood dust do not appear to be conclusive. This dust is a fire and explosion hazard. When the plant was rebuilt more extensive magnetic protection was provided against tramp iron getting into the grinders and better ventilation was installed.

Cincinnati, O. H B MCDERMID



Vent-Pipe Position Floods Condenser

ON OUR TRIAL RUN we found that our main condenser would start to flood when the 6000-hp turbine operated at a speed to drive the propeller above 60 rpm. Full speed is 95 rpm. The original vent line from the condenser to the condensate-pump suction was run as shown by the full line in the diagram. This line would air bind because of the horizontal sec-

tion, 8 ft long, from the pump to the vertical run to the condensers. As a result, the non-condensable gases at the pump's suction could not return to the condenser quickly enough.

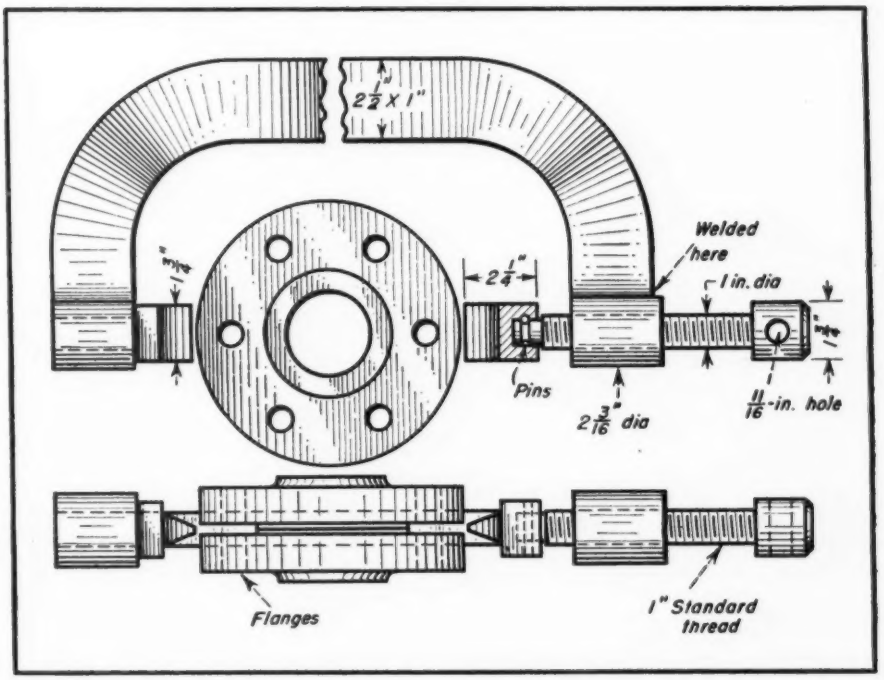
We corrected this trouble by installing the vent pipe, shown by the dotted line. This line runs vertically from the pump up toward the condenser and then inclines gradually to its top connection. When this change was made the ship met her trial run successfully.

Flushing, N. Y. S M ELONKA

Flange Spreader Makes Hard Job Easy

DRIVING A COLD CHISEL or steel wedge between pipe flanges is a common way of separating them to clean out an old gasket and put in a new one. This unsatisfactory method may damage the flange faces or even break a flange, particularly on large pipe. To overcome these difficulties I built the flange spreader in the diagrams.

Its construction is similar to an ordinary C clamp, to which have been added two wedge-shaped ends. Making the ends wedge shaped prevents them turning in the flange and injuring its faces. The dimensions given are for a unit on a 2-to 4-in. pipe. For larger pipe, the flange spreader's dimensions are increased proportionally.



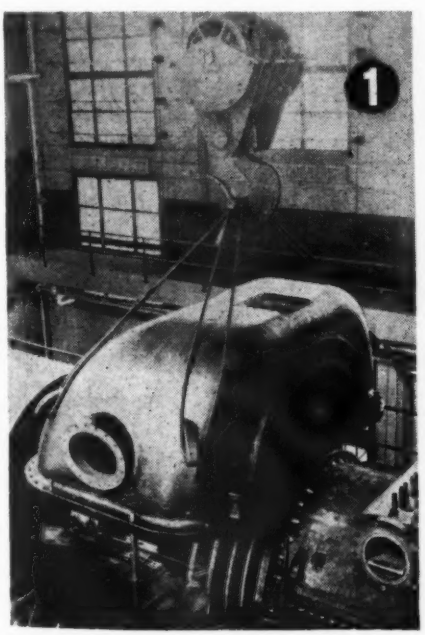
The top wedge is held on the jack screw by a pin in a groove in the screw's end, as shown. This permits the screw to turn freely in the wedge. The bottom wedge is held in the "C" by a short shank in a clearance hole. Therefore after the spreader is tightened to open the flange the desired amount the "C" can be swung to either side of it to permit easy removal of the old gasket and insertion of the new one. This device has proved a time and labor saver.

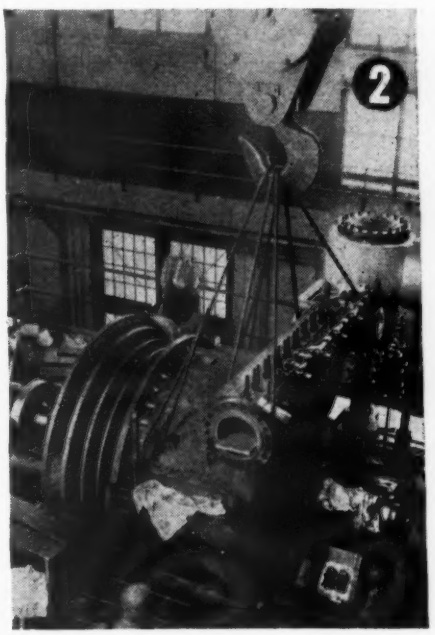
Thorold, Ont. G BARRETT

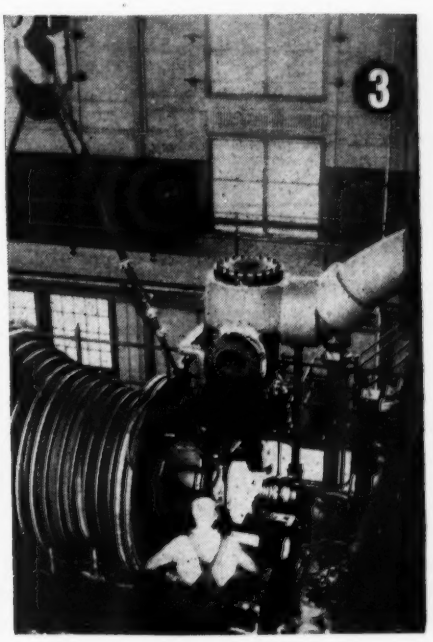
PHOTOGRAPHS USED TO RECORD MAINTENANCE PRACTICES

PHOTOGRAPHS HAVE various uses in power-plant equipment maintenance. One of these is to record wear on parts at one overhaul for comparison at the next. In this way the rate of wear can be determined.

We have found that photos save time and tempers when rigging cable slings for dismantling turbines for inspection and overhaul. The exhaust hood, high-pressure cylinder cover and turbine rotor must be lifted vertically to clear the





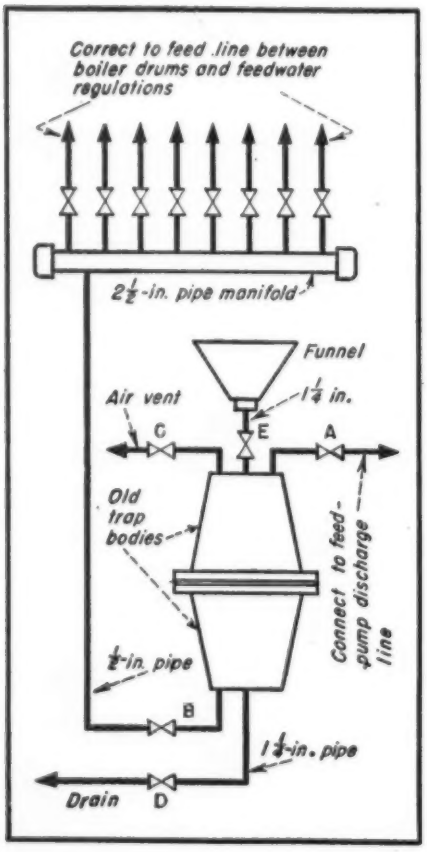


blading. At our first turbine inspection we took a series of photos showing sling details at the crane hook and lifting ears on the castings. By the use of the photos we now find it easy to duplicate the sling hitches and quickly locate the balance point for the different parts. Fig. 1 shows the exhaust hood; Fig. 2, the high-pressure cylinder and valve chest; and Fig. 3, the turbine rotor being lifted.

Duluth, Minn. GEORGE I SMITH

Chemical Feeder Serves A Bank of Boilers

FOR FEEDWATER TREATMENT we use tannin and metaphosphate. When we first used this treatment the chemicals were



fed directly from a tank to the feed pump through a regulating valve. This method did not give proper regulation of chemicals to the different boilers. We therefore devised a system, shown in the figure, that discharges the chemicals to each boiler into the feedwater line between the boiler drum and regulator.

Most of the material for this equipment was obtained from the scrap pile. The chemical container is made from two old large-sized trap bodies. After removing the internal parts we drilled and tapped a 1¼-in. and two ½-in. holes in the bottom of one body and a 1¼-in. and a ½-in. in the other for pipe connections. We bolted the bodies together with a suitable gasket between, then drilled and tapped a ½-in. hole in the side of each for a water-column connection.

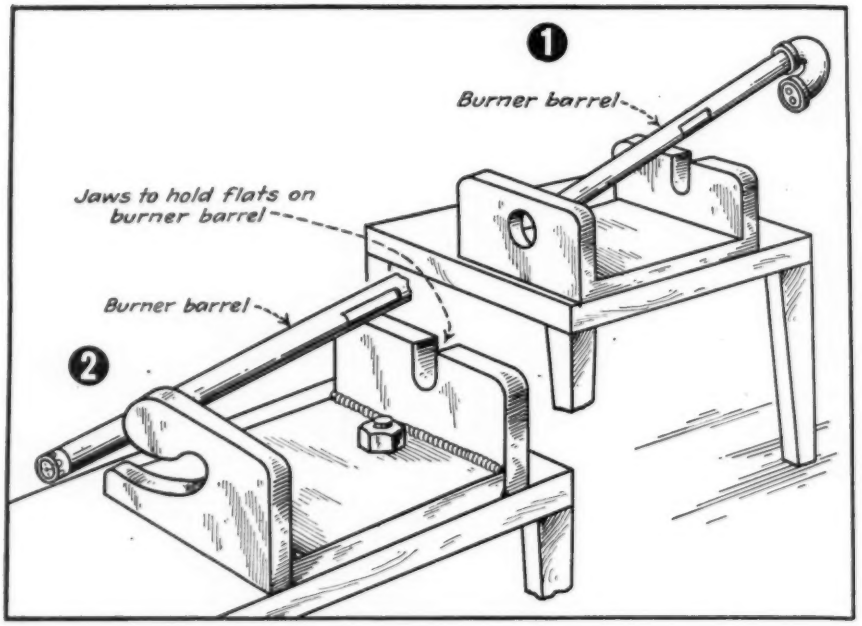
To fill the container with liquid chemicals we welded a 1¼x3-in. nipple to a large funnel to which we threaded a valve and another nipple. We screwed these into the center hole in the container's top. We also installed a gage glass from an old return tank. To connect the eight boilers to the chemical feeder we made a manifold from a piece of 2½-in. pipe, on one side of which we cut eight holes and welded in an equal number of ½-in. nipples. On the other side of this manifold we welded in a ½-in. nipple for the feeder connection.

The container is supported in a square steel plate that has a round hole in it of a diameter equal to the maximum diameter of the container. This plate rests on two wall brackets. Top of the container connects to the feed-pump's discharge line near the pump and its bottom through the manifold connects to the feed line between the feedwater regulator and boiler drum, as in the figure. In this way the pressure differential across the feedwater regulator forces the treatment into each boiler.

All the boiler-line valves at the manifold are kept closed except when treatment is being fed into a boiler. To fill the chemical container valves *A* and *B* are closed and air vent *C* and drain *D* are opened. When the container has drained empty, valve *D* is closed and *E* opened. After filling the container with treatment solution, valves *C* and *E* are closed, *A* and *B* opened.

The system is now ready to send the chemicals into any boiler, depending on which manifold valve is opened. In this way we can put a given quantity of treatment in any boiler determined by an analysis of a boiler-water sample.

Aurora, Colo. E D DUFF



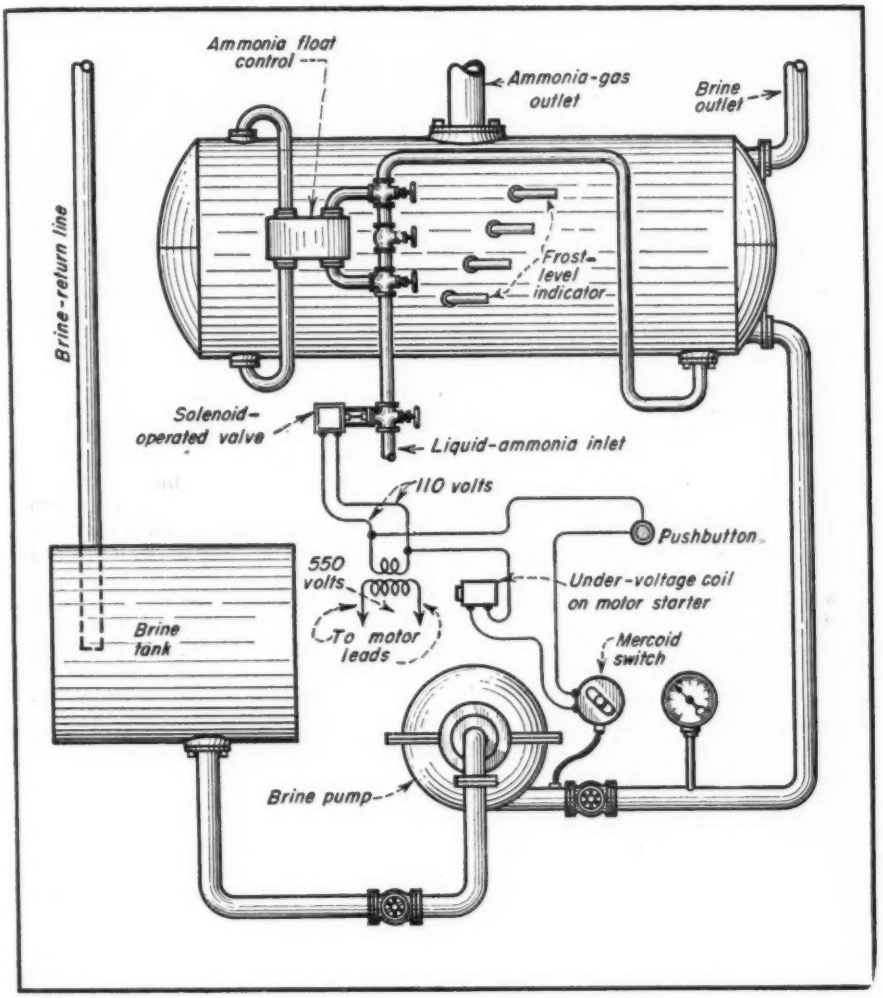
IMPROVES OIL-BURNER-BARREL HOLDER

FIG. 1 SHOWS the original holder used for our oil burners during cleaning. This holder provided a convenient means of gripping the burner barrel when removing the tip, but there was always danger of injuring the barrel's threads when pushed through the hole, as indicated. To eliminate this danger we cut a holder out of plate steel and welded it, Fig. 2.

Most of the principal dimensions of the original holder were used except that the new one is slightly higher and has a curved slot instead of a hole in which the barrel fits. The burner barrel in the new holder is brought into the slot from the side, as indicated, and removed in same way but in reverse order. At the opposite end of the holder finish the jaws to size with a file to grip the flat surfaces of the barrel with a minimum of clearance.

DEAN H BERGMANN

Bellingham, Wash.



THIS MERCOID SWITCH PROTECTS BRINE PUMP

IN A SMALL PLANT a centrifugal brine pump ran dry and almost burned out its seal rings. This trouble was caused by the gate in the suction valve becoming loose on its stem and closing. Movement of the gate on its stem combined with the corrosive action of the brine had worn the valve-stem threads so that the gate fell off. This does not often happen to gate valves on centrifugal pumps, but it will on reciprocating pumps unless the gate is jammed tight in either closed or open position.

The diagram shows the equipment layout. After the trouble with the gate valve, all valves in horizontal lines were turned from vertical to horizontal position to prevent them falling closed. We also guarded against future trouble from the pump running dry by putting a pressure-operated mercoid switch in the pump's discharge.

We connected this switch's contact in series with the no-voltage release coil on the pump-motor starter. Power to energize this circuit was taken from a transformer with its primary connected across the motor leads and its secondary to the solenoid-operated liquid-ammonia inlet valve.

Now when discharge pressure drops to a low value the mercoid switch opens and stops the pump's motor. When the motor's switch opens it deenergizes the transformer and the pump cannot start until someone investigates the trouble. Closing the solenoid-operated valve protects the evaporator tubes and prevents ammonia pressure equalizing on the high- and low-pressure sides. This valve also protects the equipment in a power failure and eliminates the necessity of having someone close the main liquid-line valve during each power failure.

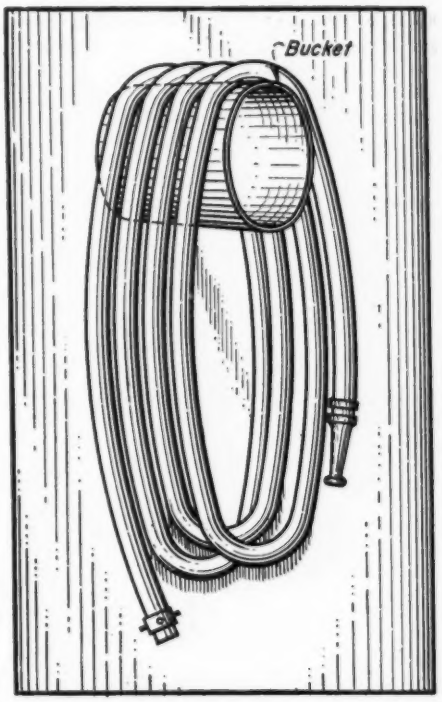
The latter is important when the system holds a large quantity of ammonia because it takes a long time to evaporate the ammonia out of the system. Also there is danger of ammonia-liquid slugs coming back into the compressor and causing serious trouble.

Ottawa, Ont. JOSEPH BONGIORNO

Compressed Air Keeps Dust Out of Regulator

IN THE PLANT of the Southern Box & Lumber Co, Wilmington, N. C., fine dust interfered with an automatic combustion control's regulator. This problem was solved by inclosing it in a box to keep out fine dust. To make doubly sure that dust would not reach the regulator the engineer connected to the box a compressed-air line with a valve, which was adjusted to maintain a slight positive pressure in the box. Air leakage from it keeps out all dust. This solution of a fine-dust problem can be applied in other places in many industries to keep equipment clean.

Pittsburgh, Pa. J T POTTER
Hagan Corp



Steel Buckets Make Hose Hangers

RUBBER OR OTHER HOSE should not be hung on spikes or pegs because the sharp bends made in the hose tend to crack it and shorten its life. We solved the problem with old steel water buckets. Where each hose is to be hung we fasten a bucket with its bottom against the wall, as in the figure. The bucket forms a large curve over which the hose hangs without short kinks. Because of the length of hose in contact with the bucket, the former does not collapse as when hung over small object. This also lengthens hose life by preventing sharp bends along its sides.

Richmond, Va. C R ANDERSON

READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

1—Can I Reclose Field Switch on This Generator?

IN OUR POWER PLANT we have three ac generators. Two are 1500-kw 80%-pf 2300-v 60-cps 3600-rpm turbine-driven machines. The third is a 750-kw 70%-pf 440-v 60-cps 300-rpm unit, direct-connected to a 2-cylinder double-acting steam engine. The switchboard for the engine-driven generator is an old-style open-front board. On two occasions the field switch to this generator was opened while the generator was operating under load. Each time we shut the machine down and restarted it just as we do when bringing it on the line. This interruption forces us to drop some load and is disrupting, to say the least.

What would happen if the operator were to reclose the field switch as fast as possible? Would it be the same as closing the line switch when the generator is out of synchronism? Would serious voltage surges result or would the generator jump out of step while operating as an induction generator? I would like to know whether POWER readers have seen or tried this stunt, and if so what happened to the generator and power system?—RSM.

2—How Do You Tear Down a Brick Chimney?

WE WOULD LIKE to tear down a radial brick chimney 115 ft high. It is surrounded by buildings so cannot be pushed or blasted down, and we don't want to pay as much to dismantle it as we did to build it. Will POWER readers tell us the best way to tear it down in the location described? If their suggested methods involve any construction details please show sketch that we can study thoroughly because we don't want any slip-up or accidents on the job.—GLK

Answers to February Questions

How Shall I Prepare Load-Distribution Chart?

(This is Question 1 from the February issue, with best answers from readers.)

Our central-heating plant consists of two hrt boilers. Each has 1150 sq ft of heating surface. One is fired with a stoker and the other by hand with coal and wood refuse from a planing mill. The plant operates from 4:00 am until 10:00 pm with output ranging from 3000 to 6500 lb per hr of steam and peaks somewhat higher. Pressure is from 100 to 125 psi. A pyrometer is installed with thermocouples in each breeching takeoff above the individual dampers. No equipment is available for checking each boiler output but I believe some economy will be effected by balancing the two units on heavy loads.

I have in mind preparing a chart, for each boiler in the operating pressure range, of flue-gas temperatures that correspond to the various loads. Opposite these values would be indicated the type of performance such as good, fair or poor. The different performance rating would include several temperatures. This chart should make it easy for the fireman to determine when to shift the load between the two boilers and how to vary it to get the best economy out of the heating plant.

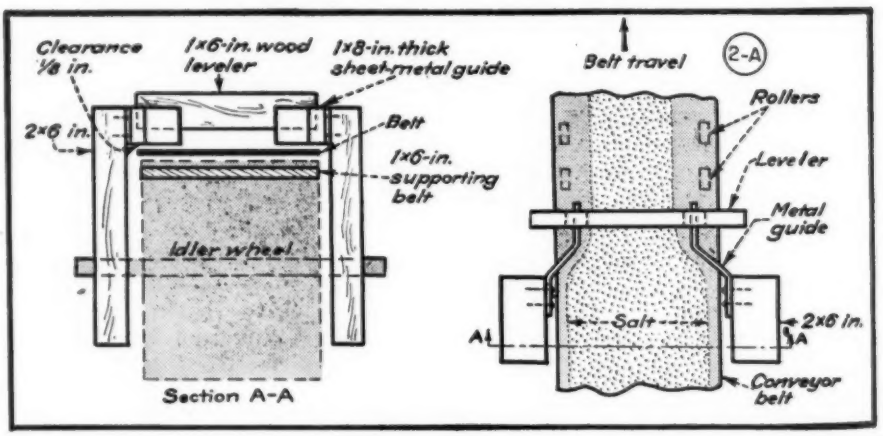
If POWER *readers have ever used such a chart will they give me some idea how to construct one, showing sample layout? If data are required other than pressure and flue-gas temperatures what apparatus would be necessary and how should it be arranged to get the data?—LGS*

Use CO_2 and Draft Gage

I HAVE SEEN load-distribution charts based on flue-gas temperatures, but after CO_2 recorders were installed the charts proved misleading because too many conditions affect flue-gas temperatures. Soot, scale, change in CO_2 content of the flue gas, and air leaks in furnace walls and boiler setting, all affect flue-gas temperature as much or more than a change in steam pressure or boiler load at any given time.

One way of improving plant efficiency is to install a CO_2 recorder and two draft gages on each boiler and keep them in working order. In most plants CO_2 recorders and draft gages soon pay for themselves in coal saved.

I suggest *LGS* install CO_2 recorders and draft gages and then carry enough of the load on the stoker-fired boiler to maintain 12 to 13% CO_2 depending upon the grade of coal burned. The other boiler can be loaded enough to burn all



wood refuse and whatever coal is necessary to maintain the required steam pressure.

Install the CO_2 recorders where they will be in plain sight when the fireman is watching or firing the boilers. The sampling tube should be located where the gas leaves the boiler tubes but not where the gas sample might be affected by air leaks around the doors at back of boiler or breeching.

One draft gage should be connected in the breeching between the boiler and the damper, the other, to the furnace just above the fire.

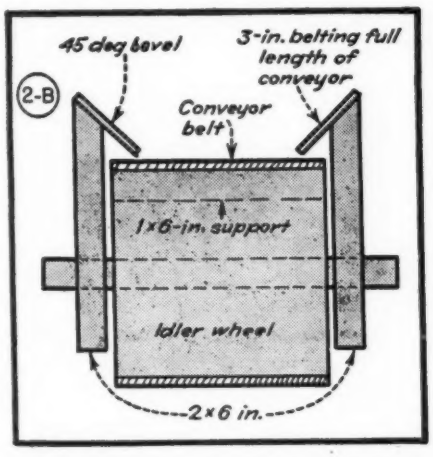
After installing a CO_2 recorder I do not believe *LGS* will find a chart necessary because most firemen soon find out that a high CO_2 content and low stack temperature mean less shoveling of coal and ashes.

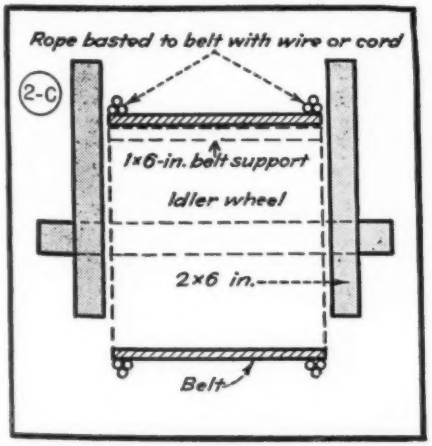
Lombard, Ill. H D BROWN

Flue-Gas Analyzer Is Best

IF I OPERATED a central-heating plant such as *LGS* describes, with a stoker and hand-fired boiler, I would not arrange a load-distribution chart to effect economy but set up a definite operating program. A load chart would be only ap-

(*Continued on page* 144)





How Can I Prevent Conveyor Spilling Salt?

(This is Question 2 from the February issue, with best answers from readers.)

In our water-treating plant I constructed a belt conveyor to carry rock salt from the warehouse to the storage bin at the dissolving tank. The conveyor, sketch Q-1, works fairly satisfactorily but salt that spills over the sides of the belt piles up under it, as shown in the insert. As this pile increases more salt is spilled, and soon is piled up so high it jams the belt and causes it to slip. I have to remove it completely every ten to 15 days and clean the conveyor. This excess maintenance is a lot of trouble and nullifies the time-saving feature of the conveyor. A wide belt would solve the problem but I would like to make the machine work without rebuilding it. How can I do this?—BDL

Install Side Guides

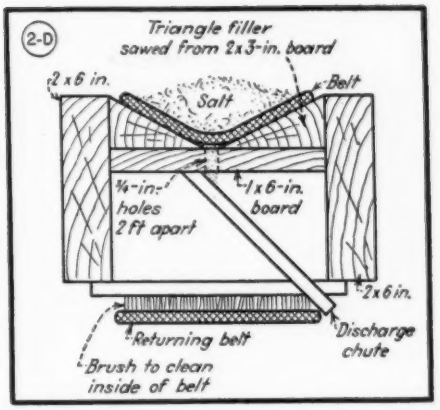
I HEARTILY AGREE that excessive maintenance is a deterrent to such labor-saving devices as *BDL's* conveyor. He can correct his trouble by sheet-metal guides, a wooden beam to act as a guide support and salt leveler and four furniture casters.

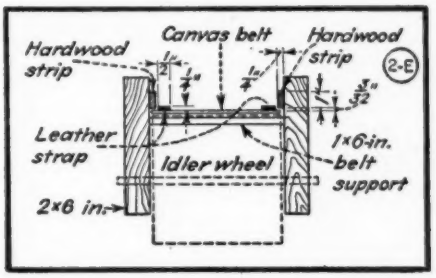
These parts should be installed as in sketch 2-A. The metal guides should have a clearance of about ⅛ in. above the canvas conveyor belt to prevent cutting and tearing it. The wood leveler acts to give uniform distribution of the salt as it is carried on the belt and also acts as a support for the metal guides. This leveler should be notched so the funneling path of the metal guides may be varied to suit operating conditions. By vertical adjustment of the leveler the height of the salt load may be varied. The roller casters are mounted to support the edges of the canvas belt. They are located about six to eight inches ahead of the metal guides so they will cup the belt just after the salt falls on it.

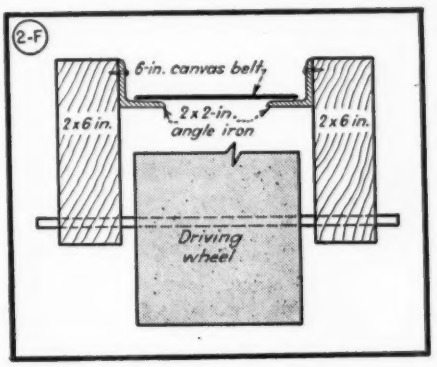
Tenafly, N. J. K B HOFFMAN

Fit Belt Into "V"

IF THE HOPPER DISCHARGE extends across the full width of the belt it should be changed to dump only on the middle of the belt. Diagonally ripped 2x3-in. boards installed as triangular pieces shown in sketch 2-D, will make *BDL's* belt run V-shaped, the same as a commercially built conveyor. Three-quarter inch holes drilled about two feet apart down the center of the groove will provide an outlet for salt that works over the edge of the belt. A trough underneath each hole will carry the salt out of the







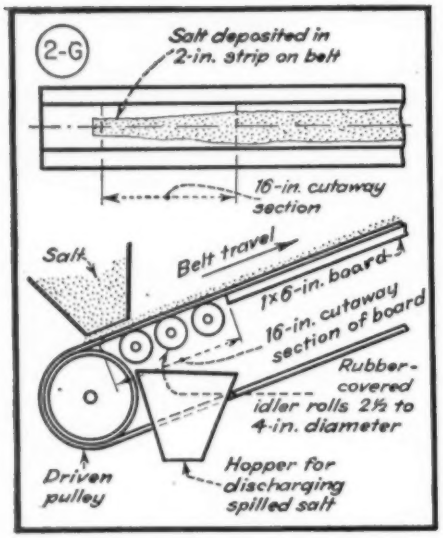
conveyor, as in sketch. An ordinary scrub brush fastened diagonally under the lower end will remove any grains that might cling to the belt.

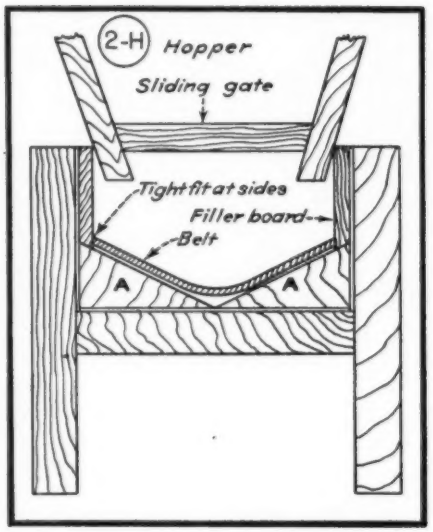
Bellingham, Wash. D H BERGMAN

Baste Rope to Belt

TROUBLE WITH THE CONVEYOR in *BDL's* problem is that the rollers on which the belt runs are flat. They should be smaller in the center than at the ends. Two pulleys could be substituted for one and set at an angle. There should also be rollers of the same size and shape spaced about 18 or 24 in. apart throughout the belt length. This allows the belt to be lower in the center than at the sides, and the material is kept to the center of the belt provided it is not overloaded. Six inches is not very wide for a conveyor belt, but if it is thin and flexible it should be satisfactory.

Another method that has worked in many cases is shown in sketch 2-C. A





piece of ¾-in. rope is basted to the belt edges with fine wire or twine and runs the full length of the belt. The rope serves for side boards to keep the material on the belt. This method is easy to apply but makes the cleaning job somewhat harder.

Baltimore, Md. C W PARKS

Use Angle-Iron Supports

RECENTLY I SOLVED a problem somewhat similar to *BDL's*, and I believe the solution will work in his case.

He should remove the board supporting the belt and replace it with two 2x2-in. angle irons, extending the length of the conveyor. By supporting the belt from the sides only, 2F on page 111, all salt that works under the belt drops through to its other side, and rolls off on the floor. If this spillage is objectionable, install a pan to collect it.

Kewaskum, Wis. J M WHITEHOUSE

Attach Belting to Sides

THE CONVEYOR in *BDL's* problem can be made to carry salt by attaching pieces of 3-inch belting along the side boards. This belting should be fastened full length on the 2x6-in. boards which have been beveled, 2B on page 111. This prevents the salt handled by the conveyor getting under the belt.

The belting should be carefully adjusted not to drag too heavily on the conveyor belt because this would increase the power consumption. The feed hopper should be adjusted to feed correctly on the new belt arrangement.

Mexico, Mo. F HICKMAN

Make Depression for Belt

A SLIGHT CHANGE in design, as in sketch 2-H, is easy and inexpensive to install, and will help *BDL's* conveyor.

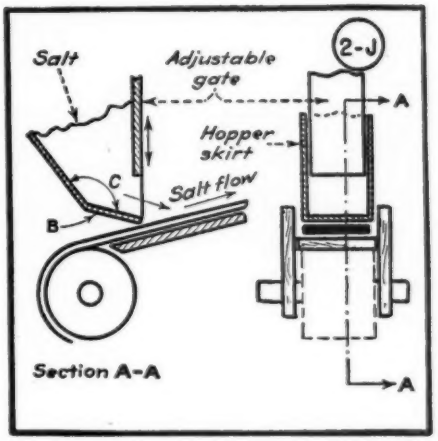
A 2x4 in., ripped diagonally and half placed under each side of the belt makes a depression in the center that keeps the salt in place. A board thick enough to touch the edges of the belt should be put on each side of trough to close any space left.

The discharge-opening of loading hopper should be set parallel with belt and have a sliding board, as in the sketch, that can be adjusted to give a full load but not enough to overload the conveyor.

Dayton, Ohio C A RUSSELL

Rivet Straps on Belt

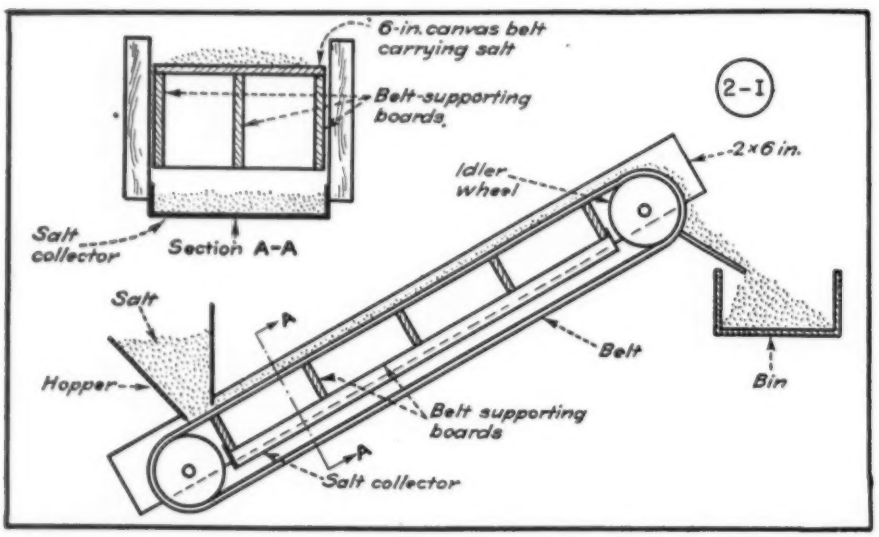
I SUGGEST ADDING two small hardwood slats on the inside of *BDL's* conveyor above the belt, running them the full length of the conveyor, 2E on page 111. These slats should be fastened with flat-



head wood screws. In addition, he should rivet two narrow leather straps to the canvas belt, one on each side, also shown in the sketch. The leather should be softened by oiling thoroughly with a good grade of harness oil, and then thoroughly coated with a waterproof wax to prevent moisture in the salt hardening it. This may cut the capacity of the conveyor slightly but it will prevent most of the salt getting under the belt.

A small cleanout door in the conveyor's side near the hopper will allow what salt spills over to be removed without stopping the conveyor.

Long Beach, Calif. S R HIGGINS



Remove Salt Under Belt

BDL SHOULD ALTER the hopper outlet to discharge a narrow stream of salt about 2 in. wide to the belt. He should also vary belt speed to give the least spillage. A wider troughed belt would improve operation. If, however, the required capacity can be delivered by a

6-in. belt at not over 300 fpm with a salt stream width of 4 in. or less, the faults described will be overcome. I suggest that the 1x6-in. board be cut out for a distance of about 16 in. and rubber-covered idler rolls installed as in sketch 2-G. Make rolls of wood or steel pipe covered with hose or rubber in any form available. A chute can be fitted to collect and discharge salt that bypasses the belt. Operation of the conveyor will be greatly improved if the belt is driven from the discharge-end pulley instead of the receiving-end.

Saint John, N. B. C G CLARK

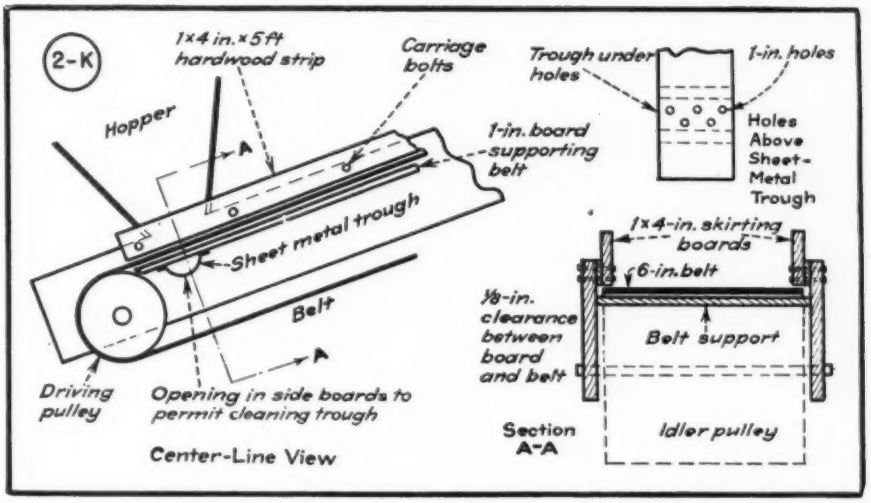
Adjust Hopper Feed on Belt

IF THE HOPPER IS REBUILT, as in sketch 2-J, *BDL* can feed salt onto belt in direction of its travel. This should keep the sides of the hopper from spreading the salt out too wide. Board at *B* will support the weight of salt in the hopper and thus help eliminate spreading. Angle *C* should be adjusted so that flow is at correct rate. The adjustable gate gives final control over salt flow onto the belt and should be adjusted for operating conditions.

Detroit, Mich. C M DAVIS

Use Edgewise Supports

BDL'S PROBLEM can be solved at minimum cost by merely changing the wooden-belt support. Since salt tends to collect between the belt and the board supporting it, he will avoid the trouble by replacing the flat board, which is parallel to the belt, with three boards lying in a vertical plane or edgewise to the belt as in sketch 2-I. These boards are braced at reasonable intervals with small boards set at right angles. This arrangement provides both longitudinal and lateral support for the belt, and prevents the salt accumulating under it. If *BDL* desires to collect salt that spills from the belt, a sheet-metal collector running parallel to the belt



may be installed, as in the diagram. He can remove the salt at regular intervals from the lower end of the metal trough.

ANTONIO DI LORENZO

West New York, N. J.

Install Skirts Over Belt

I BELIEVE THE DIFFICULTIES with *BDL's* conveyor belt will be overcome by installing hardwood skirting boards over the edge of the belt, as in sketch 2-K.

These boards should be fastened to the side boards so the clearance between bottom of skirt and top of belt is about 1/8 in. They should overlap the belt about 3/4 in.

The trough placed below the holes drilled in belt support extends through both side boards so that any salt gathering there can then be cleaned out.

Hamilton, Ont. J A COULDEN

Make "V" in Bottom

A SOLUTION of the conveyor problem can be effected by attaching side boards to the 2x6-in. boards on the side of the belt. Use light, hard fiber such as masonite for the side boards. They should be attached at an angle to the 2x6 in., protruding over the belt edge about 1 in. on each side to check salt leakage.

Another solution would be to have the supporting board "V'd" to produce an appreciable hollow in the center of the belt. A combination of the two as in sketch 2-M, would be very effective.

Guides should be attached to the discharge end of the hopper to concentrate the salt on the belt's center.

New Orleans, La. W R KILBOURN

Curve Belt From Sides

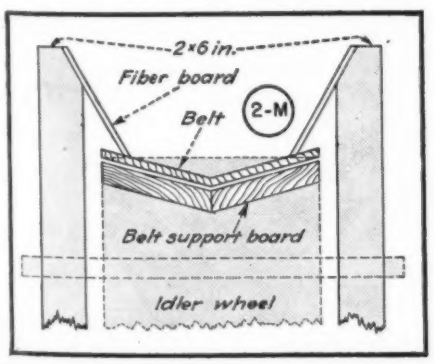
BDL COULD USE STRIPS of sheet metal 2½- or 3-in. wide extending the length of the conveyor. By curving these strips as in sketch 2-L, and fastening them to the sides and bottom of the conveyor's trough they would tend to make the belt concave and keep the salt in its center. The ends should be tapered so there will be no rough or square edges to wear the belt.

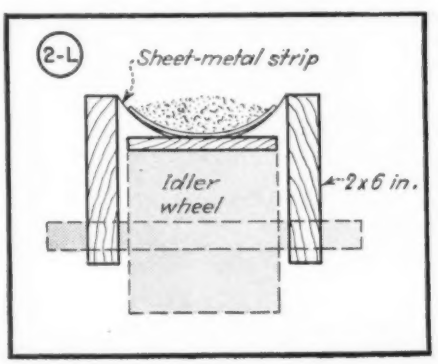
Plattsburg, N. Y. N F SWIFT

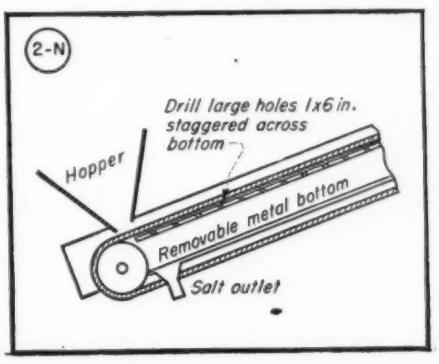
Bore Holes in Support

IF BDL'S CONVEYOR is installed at an angle, as in sketch 2-N, his difficulties should be fairly easy to solve by boring large holes through the 1x6-in. board

(*Continued on page* 150)







REFRIGERATION NOTEBOOK — 28

How to Test for Leaks In an Ammonia System

By TERRY MITCHELL, ME, *Frick Company*

EDITOR'S NOTE: *Here is the first of two articles describing the procedure to follow when preparing a new ammonia refrigerating plant for operation.*

► BEFORE PUTTING an ammonia refrigerating system into service check the ammonia, water and brine piping, and the electric connections to make sure they correspond with the drawings. Then familiarize yourself with the uses of the different valves and switches. See that compressors, motors and pumps are properly lubricated. If possible, disconnect the automatic controls so the plant can be operated manually. But do not open the compressor: It has been carefully assembled and adjusted at the factory. You may have to pack the shaft stuffing box, put oil in the crankcase and force-feed lubricator. Pump the lubricator by hand until the oil lines are full.

Turn on the cooling water to the condenser and compressor cylinder jackets. Remove the suction scale-trap cover on the compressor manifold to provide an air inlet. Open the main discharge and close the main suction and bypass valves on the compressor; open all other ammonia valves between parts of the system, and close those leading to the outside air. Then start the machine and slowly pump an air pressure of about 150 psi on the system.

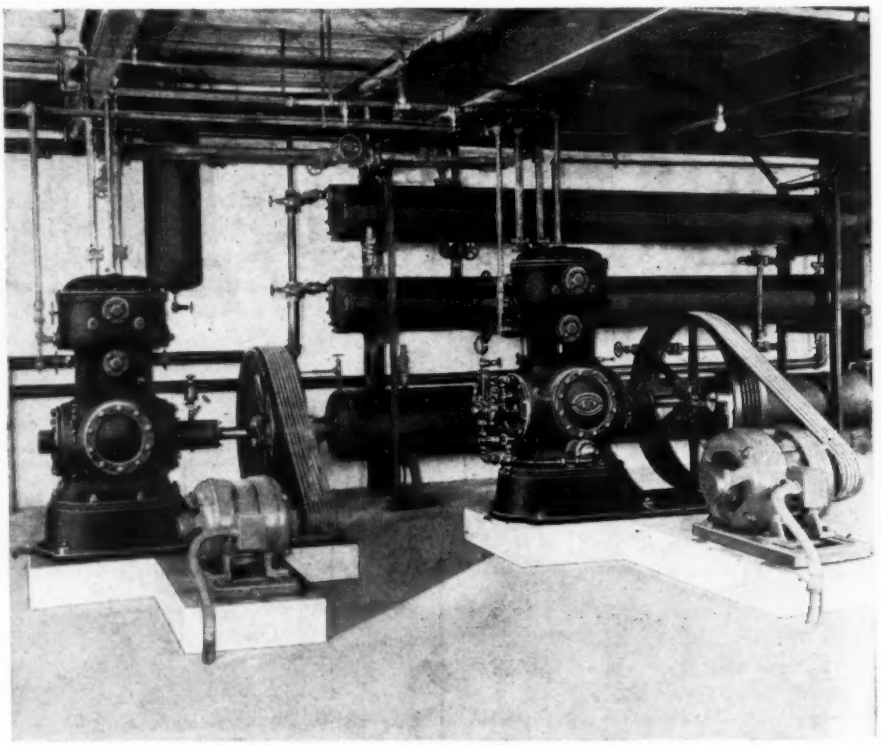
Pump Air With Caution

Remember that a refrigerating machine is not an air compressor; pump 20- or 25-psi pressure at a time, then stop to allow valves and pistons to cool. Continuous pumping may make the cylinder so hot that the oil will burn or even flash into flame, causing an explosion. Watch the pressure gages closely while the machine is running; make certain that the pressure in the cooling coils does not go above 150 psi, as they are generally not built to stand any higher pressure.

After reaching a moderate air pressure, stop the machine, close the valves on the compressor, and go over the entire system, looking for leaks. Bad leaks can of course be heard; small ones are found by painting the joints with a thick solution of soap and water. If the bubbles do not show a leak it can be located after the ammonia is charged into the system, by passing a torch of burning sulphur under the pipes; sulphur fumes react with ammonia gas to form a pale white smoke. Having marked any leaks, blow the air from the system through the receiver drain valve (not the compressor); dismantle the faulty joint and repair it. Test by pumping a higher pressure. When the system appears tight, blow out the air, repeating the process until all dirt and scale are removed. Then replace the scale trap cover, and prepare to pump a vacuum.

A valve or pipe plug is provided on the discharge part of the manifold for releasing air while running the machine with discharge valve closed. Open main suction valve, and crankcase pumpout valve; discharge valve may be closed after manifold air outlet is opened. Keep all other valves set as when pumping an air pressure. Start the machine and exhaust the air from the system until the low-pressure gage shows the highest vacuum the compressor will produce. (The gage may or may not read accurately at very low pressures.) Let the plant stand idle for several hours to see whether the vacuum holds; if so, the system is tight. If not, tighten the valve-stem packing nuts a little, and draw up on the stuffing-box gland slightly; then pump the vacuum again. You may have to pump an air pressure once or twice more before finding the last leak in an extensive system. In time a small leak wastes considerable refrigerant.

Finally, take the system valves apart, including those on compressor manifold, and remove the scale and water that tend to collect when air is blown out. Clean stems, disks and seats thoroughly, coat with ammonia oil, and reassemble. Check for tightness by pumping and holding a vacuum on the entire system.

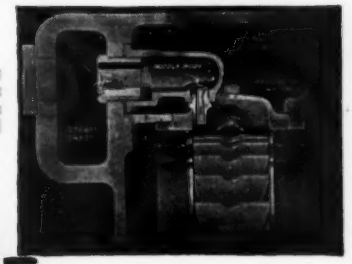


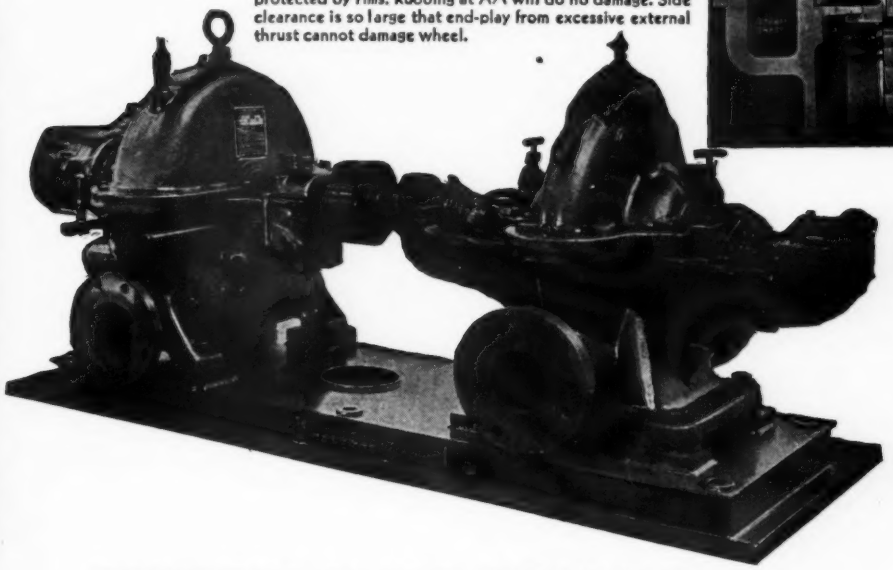
Familiarize yourself with individual parts of a system. Understand the operation of each apparatus as well as its function with relation to the plant as a whole

TERRY

DIAGRAM SHOWING WHEEL CLEARANCES

AA—Rim clearance, B—Large blade clearance, CC—Side clearance, (about one inch). Blades cannot foul, as they are protected by rims. Rubbing at AA will do no damage. Side clearance is so large that end-play from excessive external thrust cannot damage wheel.





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CENTRIFUGAL PUMP Q AND A FOR POWER ENGINEERS

By I J Karassik and Roy Carter

14—Priming Methods and Equipment

Fourteenth in a monthly series by Igor J Karassik and Roy Carter, Worthington application engineers. These two experts on centrifugal pumps have selected questions and answers that give a broad, practical understanding of the pumps, their construction, operation, characteristics, troubles and remedies.

Q 1—What is meant by priming a centrifugal pump?

A—It is the removal of air, gas or vapor from the pump's waterways by filling them with liquid to be pumped. Priming is done manually or automatically.

Q 2—Why are centrifugal pumps not self-priming like positive-displacement units?

A—Positive-displacement pumps handle air as well as liquid if properly sealed and, therefore, exhaust air from their suction side. Centrifugal pumps, contrary to most people's understanding, pump air to the same head in feet that they develop on a liquid. Because of the low gravity of air, the actual pressure developed when pumping it is very small. Thus, a centrifugal pump running at normal speed produces very little vacuum measured in feet of water. For instance, a pump that develops 200-ft head handling water likewise produces 200-ft head of air. However, a head of 200 ft of air is equivalent only to a vacuum of about 3 in. of water, which is insufficient to produce priming.

Q 3—Does a centrifugal pump that has a positive-suction head have to be primed?

A—When first put in service or after servicing, the waterways of the pump are filled with air. If the suction supply is under pressure and the suction valve is opened, this air is trapped in the pump. Unless suction pressure is high enough to force the air into the volute, the pump will not be primed. It

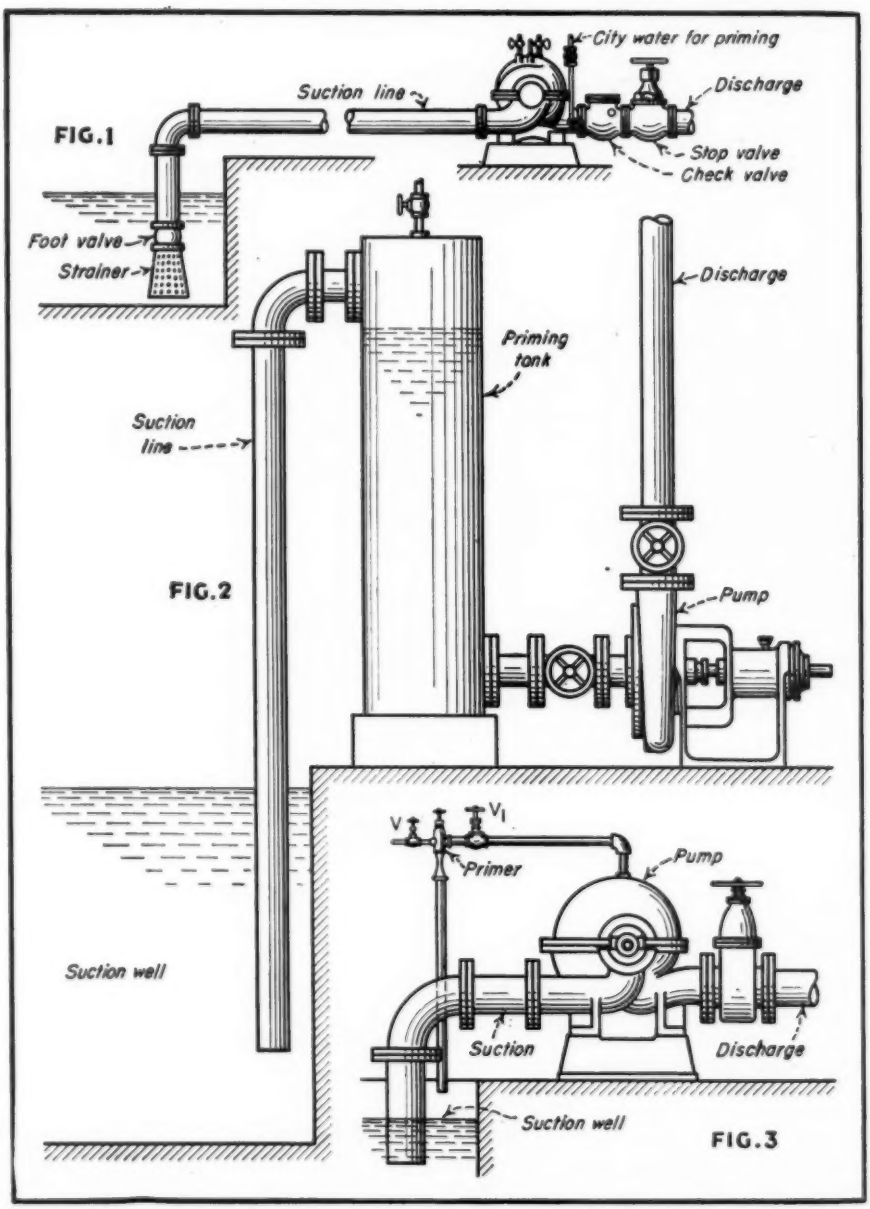

Fig. 1—Foot valve, a form of check valve installed at bottom end of the suction line to prevent any liquid flowing back into the suction well. This valve permits the pump to be primed by filling it from the city line. At the same time, air is released from the casing through a petcock on top of the pump's volute. Fig. 2—Tank in suction line holds enough liquid to permit the pump to prime automatically after shutdown. Fig. 3—Ejector connected to casing top to prime a centrifugal pump

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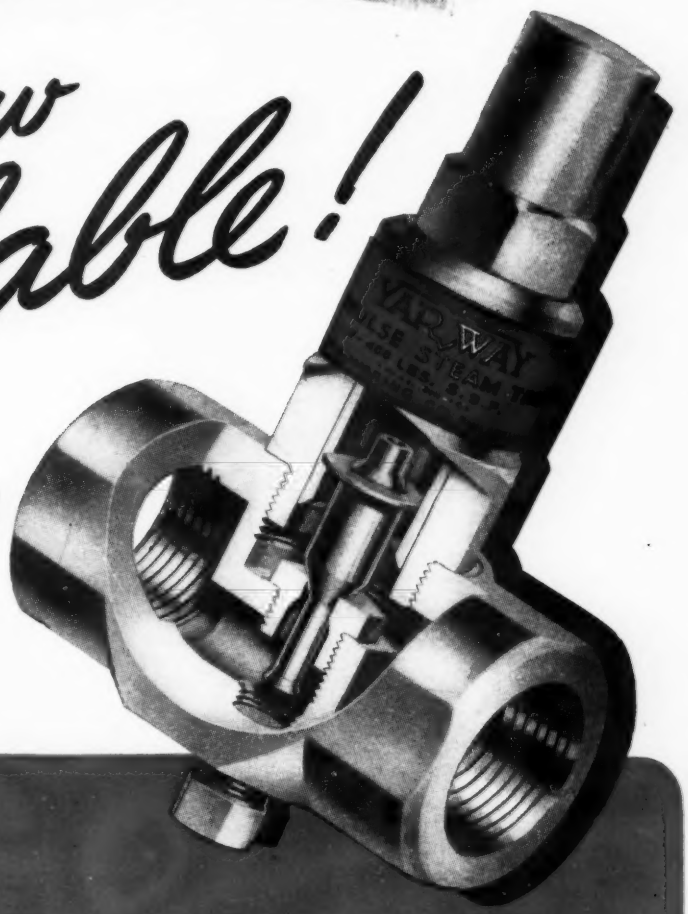

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PUMP Q&A

Continued

is, therefore, necessary to provide for removing this entrapped air.

Q 4—How is a centrifugal pump primed?

A—It is primed by venting the entrapped air out through a valve for that purpose if the pump has a positive-suction head. If suction-supply level is below the pump, air must be evacuated from it by some vacuum-producing device. A foot valve must also be provided in the suction line's intake end to permit filling the pump with water, or a priming chamber connected in the suction line near the pump.

Q 5—What is a foot valve?

A—It is a form of check valve installed at a suction line's bottom end, Fig. 1. Like a regular check valve, a foot valve allows flow in one direction only, in this case towards the pump. When the pump is stopped, water remains in it to keep it primed. Foot valves do not always seat tightly so that pumps equipped with them occasionally lose their prime. In such cases, rate of leakage is usually small and the pump can be primed by filling it with water before starting. This uncertainty after foot valves wear or when water contains foreign matter, results in a preference for vacuum-priming devices.

Foot valves are not suitable for liquids containing foreign matter and are also undesirable because friction-head loss through them is generally high.

Q 6—What is a priming chamber and how does it function?

It is a tank with an outlet at its bottom connected to the pump's suction nozzle and an inlet at its top connected to the suction line, as in Fig. 2. The tank must have roughly three times the suction pipe's volume. Air leakage when the pump is shut down may cause the liquid to leak from the suction line but most of the liquid in the tank cannot run back to the supply. When the pump is started, it draws the liquid from the tank and creates sufficient vacuum in the suction line to cause liquid to flow into the priming chamber.

Precautions must be taken to prevent vortexing at the tank's outlet and siphoning when the pump stops. Except in special cases, it is generally more advantageous for pump users to buy a commercial priming chamber with proper automatic vents and other features than to attempt to make their own. Because of their size priming chambers are restricted to relatively small pumps.

Q 7—What vacuum-producing devices prime a centrifugal pump?

A—Practically every commercially made vacuum-producing device is used. Formerly water and steam-jet ejectors were generally adopted, but with increased use of electric power, motor-driven vacuum pumps became popular. Wet-vacuum pumps are favored for manually controlled units, as they are not damaged by water slugs carried over into them. Dry-vacuum pumps are used extensively for central-priming systems.

Q 8—How are ejectors used for priming?

A—Ejectors serve for priming on the jet principle using steam, compressed air or water as the operating medium. Fig. 3 shows a typical hook-up for priming with an ejector. Valve V is opened to start the ejector and then valve V_1 is opened. When all the air has been exhausted from the pump casing, water is pulled over and discharged to the suction well. When this occurs the pump

(*Continued on page* 140)

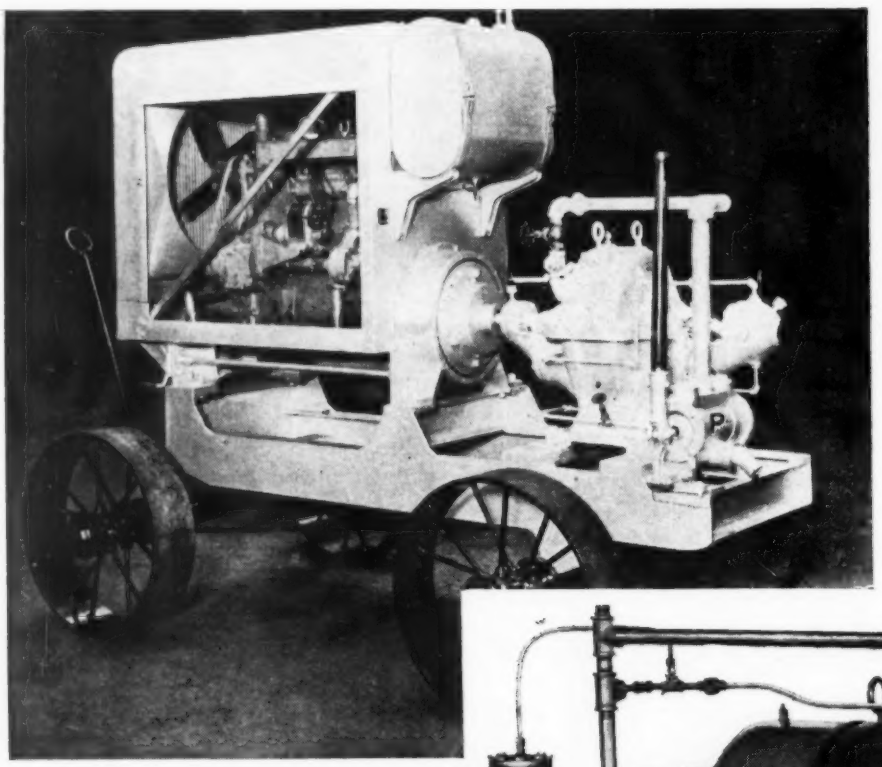

Fig. 4—Hand-operated primers, which are displacement pumps like that at P on this centrifugal pump, were quite commonly used, but they have now been generally replaced by other devices.

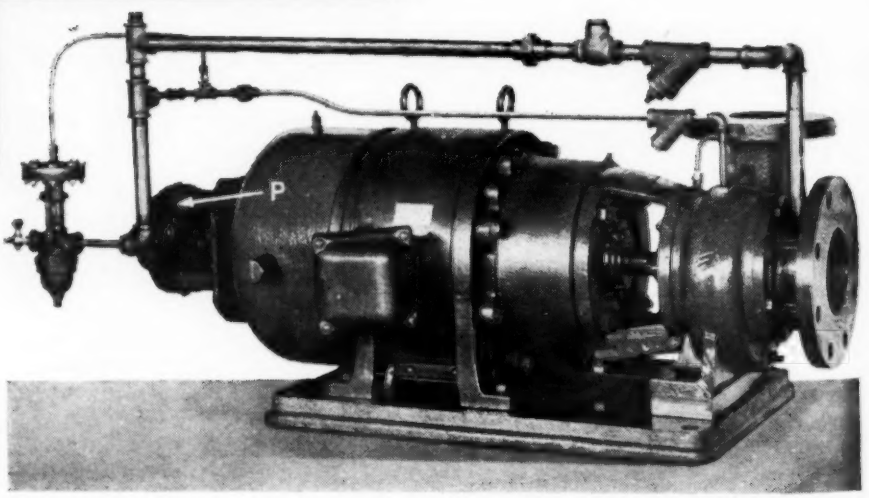

Fig. 5—This motor-driven close-coupled centrifugal pump is primed with an automatically controlled wet-vacuum pump, P, directly driven from the motor shaft. After priming, controls open vacuum pump's suction line to atmosphere

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MATH TIPS

PHIL SWAIN GIVES HELPFUL HINTS TO EVERYDAY USERS OF NUMBERS AND HOMESPUN MATHEMATICS

⑪—Logarithms: Time-Saving Invention

▶ LOGARITHMS WERE INVENTED many years ago as a shortcut to save time in multiplication and division primarily, and secondarily in such operations as powers and roots.

"Logs," as they are abbreviated, substitute addition for multiplication, subtraction for division, multiplication for powers, and division for roots.

The ordinary slide rule, which is laid out from tables of logarithms, performs almost any operation you can perform with log tables. However the accuracy of a slide rule is limited by the length of its scale. With close reading the lower scales of an ordinary 10-in. slide rule cannot be read closer than 1/10 percent. This is near enough for many engineering problems. Where closer figuring is required you must use longhand figuring, a computing machine, or a table of logarithms.

This article, and two to follow, will explain simply what logs are and how they are used for the ordinary operations of multiplying, dividing, finding powers and extracting roots.

In the so-called higher mathematics logs have various bases, but in ordinary work, unless otherwise specified, the base is always assumed to be 10. That will be assumed in these articles.

Definition

The log of any number is simply the power to which 10 must be raised to give that number. Thus to get 1000 you have to cube 10, raise it to the third power. That is $10 \times 10 \times 10 = 1000$. Therefore the log of 1000 is 3. We would write it this way: log 1000 = 3.

In the same way log 100 = 2, log 10,000 = 4, log 10,000,000 = 7, and so on.

The logarithm of 1 is 0. For any number less than 1 the logarithm is negative, or a minus quantity. Sticking to the powers of ten, and running down from large numbers through 1 to smaller numbers we find that the logs follow in a consistent series, as shown at the left in "Simple Tables of Logarithms."

We won't attempt to explain the meaning of negative powers except to note, for example, that 10 to the minus four power is 0.0001, so the log 0.0001 = −4.

Inspecting the table just given we get the following rule for the logs of the powers of 10.

The log of 1 is 0. If the number is 10 or more the log is equal to the number of zeros. If the number is 0.1 or less the log is one more than the number of zeros between the decimal point and the 1.

Here is the rule for multiplying any two numbers:

The sum of the logs of two or more numbers is the log of their product.

Problem: $10 \times 1000 \times 0.01 \times 100 = ?$
Sum of logs = 1 + 3 −2 + 2 = 4
Therefore the product must be the number whose log is 4. This must be 1 followed by four zeros, or 10,000.

Here is the rule for division:

To divide a first number by a second subtract the log of the second from the log of the first. The difference is the log of the quotient.

Problem: 1000 ÷ 10 = ?
Log 1000 − log 10 = 3 − 1 = 2 = log 100
Therefore 1000 ÷ 10 = 100.

Problem: 0.01 ÷ .001 = ?
Log 0.01 − log .001 = −2 − (−3) = −2 +3 = 1
The number whose log is 1 is 10.
Therefore 0.01 ÷ 0.001 = 10.

Granting that these computations are easy, the reader may well ask what use they are, since all these operations with the powers of ten are perfectly easy without logs. The answer is that this is the best way to begin to understand logs.

For the next step in understanding note the accompanying table of 4-place logs of the whole numbers from 1 to 10.

Test this with a few simple computations.

Problem: 2 × 3 = ?

log 2	0.3010
+ log 3	0.4771
Sum	0.7781 = log 6 (almost)

The product is 6. Note that the operation does not necessarily give the exact answer. Logarithms always involve some error, but it can be made as small as desired by using log tables with more decimal places. A 5-place log table is accurate enough for almost any engineering computation, but astronomers, for example, sometimes use 7- and 8-place tables for their ultraprecise computations.

Problem: 8 ÷ 4 = ?

log 8	0.9030
−log 4	0.6021
Difference	0.3009 = log 2 (almost)

The quotient is 2.

(*More about logarithms in May—Editor*)

SIMPLE TABLES OF LOGARITHMS

Large numbers through 1 to smaller numbers

Powers of ten	*Log*
10,000	4
1,000	3
100	2
10	1
1	0
.1	−1
.01	−2
.001	−3
.0001	−4
.00001	−5 etc.

Four-place logs of the whole numbers 1 to 10

Number	*Log*
1	0.0000
2	.3010
3	.4771
4	.6021
5	.6990
6	.7782
7	.8451
8	.9031
9	.9542
10	1.0000

A STEEL STOP VALVE on which YOU CAN STANDARDIZE

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It's no longer necessary to buy a different type of forged steel stop valve for every different service. Here's a valve on which you can standardize—one that fits 90 per cent of normal services where forged steel stop valves are used.

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Fig. 2698 –Globe, inside screw, 600 lb sp.

Fig. 2699 -Angle, inside screw, 600 lb sp.

Similar design, O.S. & Y. type, also carried in stock.

For design and dimensional details on these and other Edward steel valves, write for Catalog No. 103.

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HOW TO MOUNT GRINDING WHEELS PROPERLY

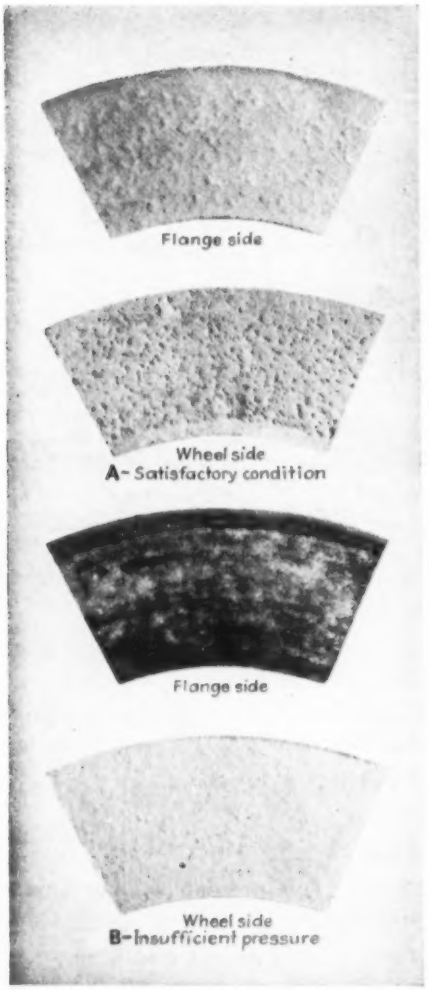
► RESPONSIBLE MANUFACTURERS take every possible precaution to produce grinding wheels that are free from defects. Before shipment they are carefully inspected, those over 5 in. diameter being subjected to a speed test high enough to reveal inherent weakness.

From here on it is the user's duty to determine whether the wheel has been damaged in shipment, and to keep it in good condition. Before mounting a wheel, suspend it free and tap lightly with a screwdriver handle or wooden mallet. If wheel does not ring clear a crack is indicated. Exceptions to this rule are rubber- and shellac-bonded, or damp, wheels, also those recently unpacked, to which sawdust still adheres. Remove sawdust or other packing material and clean the wheel thoroughly.

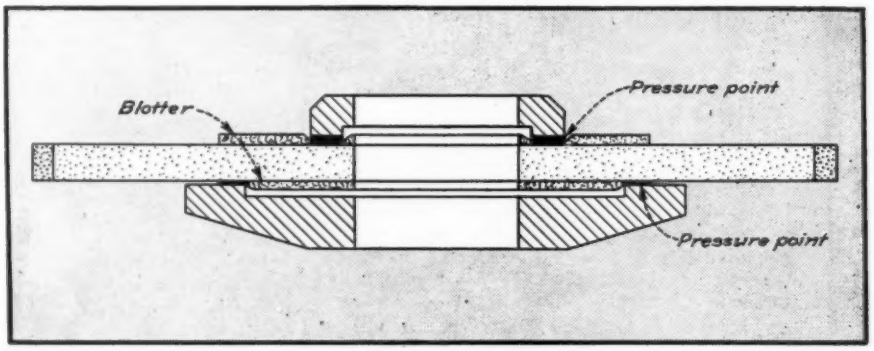
Next step is to prepare for mounting. First precaution is to see that both flanges are the same diameter with their inner faces machined out from the center as shown in Fig. 3. Second, cut blotting-paper washers or provide flange facings of compressible material to insert between the metal flanges and grinding wheel.

Washers of blotting paper should not be over 0.025 in. thick; those of rubber or leather not more than 0.12 in. thick, with their diameter at least equal to that of the flange. Cut a hole in the washer center slightly larger than the spindle. If the flanges are faced with lead or babbitt the facing should be at least ⅛ in. thick.

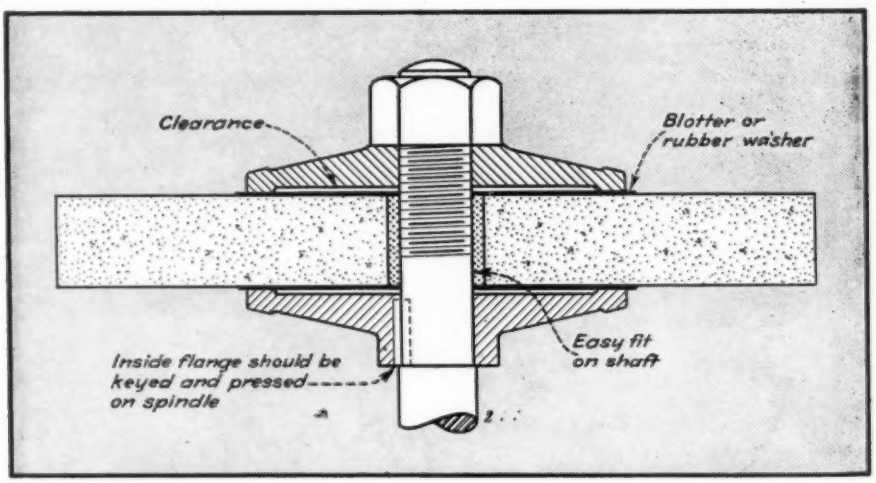
Third, see that the hole in wheel center is just large enough to slide easily on the machine spindle without using force. After the wheel is in place and protected by suitable washers or facings, tighten the flange nut. Draw up only tight enough to hold wheel firmly and spin several times by hand to see whether it runs true. Consult the American Standards Association safety code, *The Use, Care and Protection of Abrasive Wheels*, for information on flange construction. *Courtesy of the Norton Co.*



1 If nut is tight, grain imprint is on flange side of washer, *A*. If too loose, the flanges slip and burn washer, B.



2 Flanges of unequal diameter are a definite accident hazard. Unbalanced pressure of the flanges will break the wheel. Also the lower washer is too small and wheel flange does not have full bearing surface on the soft washer. Watch this carefully.



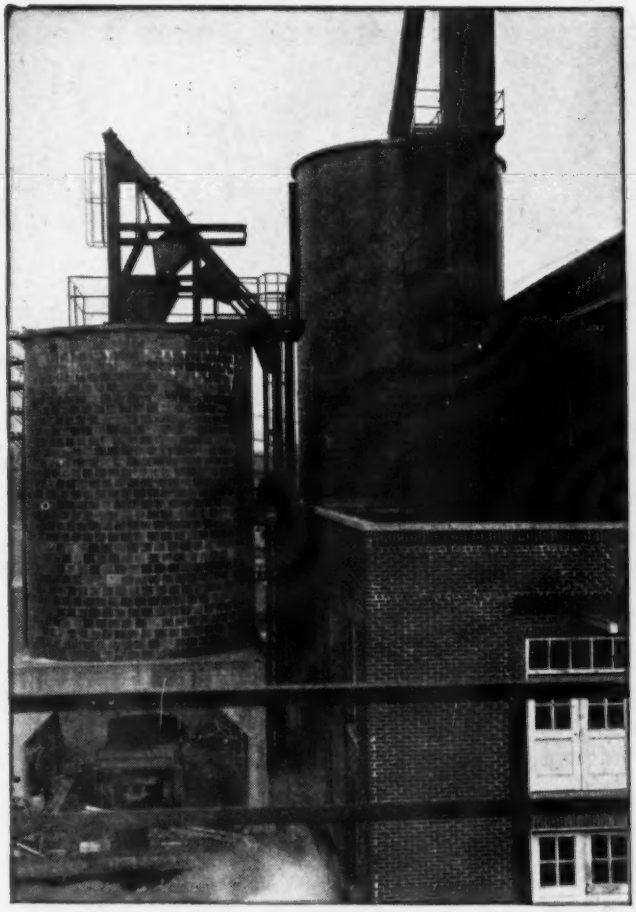
3 A correctly mounted wheel has an easy fit on the shaft; inner flange keyed and pressed on the spindle; both flanges of the same diameter and relieved to provide clearance and compressible washers between the abrasive wheel and flanges.

FAIRFIELD

Coal and Ash Handling SYSTEMS

Designed— Built— and Erected by

FAIRFIELD

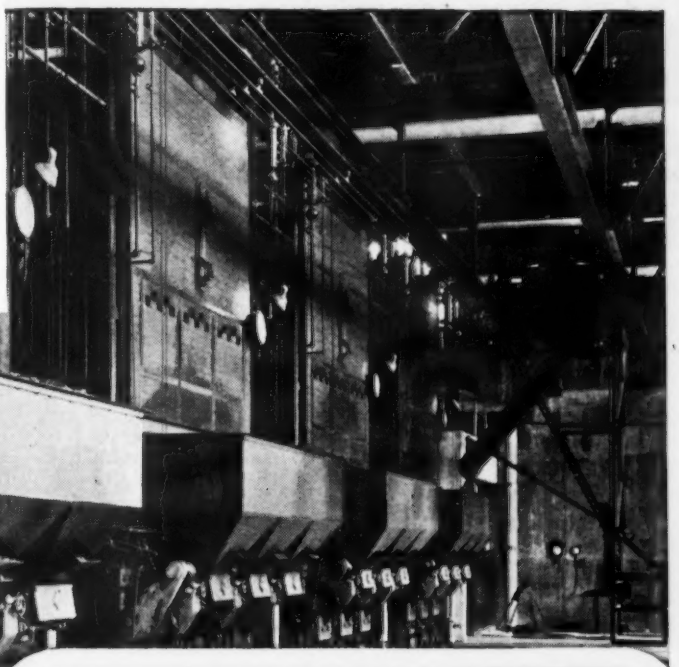


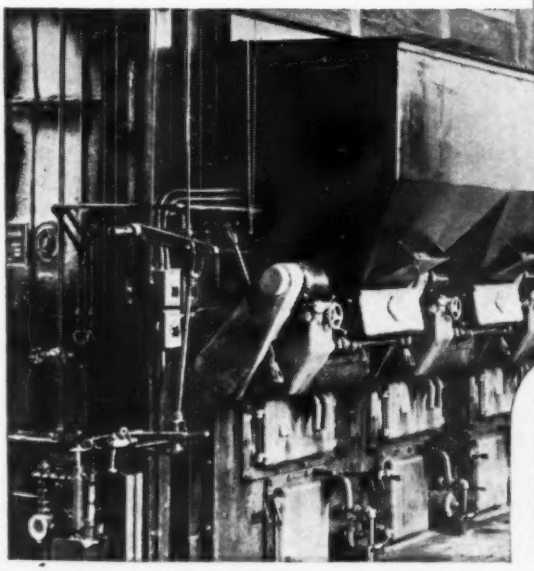
The coal and ash handling system illustrated is typical of the Fairfield method of designing and erecting a complete system to meet the needs of the individual plant. Note that the coal silo is an integral part of the power house and coal is fed to silo by means of an elevator.

The ash silo adjacent to the power house uses a skip hoist for handling ashes from boilers to silo. Both the coal and ash silos are made of vitrified tile which resists moisture—air channels in tile act as insulation against freezing in cold weather and locating silos outside of boiler room eliminates dirt inside.

The lower illustration shows the use of a weigh larry for distribution of coal from silo to stokers. This has advantage of flexibility as any one of a battery of boilers can be fed independently, and the weight of coal burned by each unit can be recorded.

If you need an extension to your present plant or are considering a new one—consult Fairfield on automatic handling and storage of coal and ashes. There's a representative near you—call on him—no obligation.





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FOR THE ENGINEER'S BOOKSHELF

BOOKS REVIEWED IN THIS ISSUE

ELECTRONICS FOR ENGINEERS • PRIMARY AND STORAGE BATTERIES INSPECTION OF ELEVATORS • INDUSTRIAL ALGEBRA AND TRIGONOMETRY BETZ HANDBOOK OF INDUSTRIAL WATER CONDITIONING MACHINE-TOOL WORK—FUNDAMENTAL PRINCIPLES • ALEMITE ANSWERS REPAIR SHOP DIAGRAMS AND CONNECTING TABLES FOR LAP-WOUND INDUCTION MOTORS • BALL AND ROLLER BEARING ENGINEERING INDUSTRIAL ELECTRIC WIRING • CONDUCTORS AND WIRING LAYOUTS

Electronics

ELECTRONICS FOR ENGINEERS—(1945) *Edited by John Markus and Vin Zeluff, associate editors, "Electronics."* 390 *pp*, 8½x11, *illust, tables, cloth.* $6. *McGraw-Hill Book Co*, 330 *W 42nd St, New York* 18, *N. Y.*

A collection of 142 articles, reference sheets, charts and graphs for design engineers, builders, and users of electronic equipment and component parts, reprinted from *Electronics*. This condensed information, in graph and chart form, has been in great demand for reference use by engineers engaged in designing circuits, equipment and individual parts for radio, electronic, television, facsimile, radar, sound and related vacuum-tube apparatus. The articles and accompanying charts and graphs, edited and arranged in groups, with a cross-index, cover 27 subjects, including A-F impedance-matching networks, antennas, audio amplifiers, capacitors, cathode-ray tubes, electronic heating, etc.

Elevator Inspection

INSPECTION OF ELEVATORS (*second edition*—1945) 125 pp, 5½x8, 42 *illust*, 6 *tables, cloth.* $1.25 *American Society of Mechanical Engineers, 29 W 39th St, New York* 18, *N. Y.*

Approved by the American Standards Association this manual serves as a guide for all elevator inspectors. Based on the *American Standard Safety Code for Elevators, Dumbwaiters and Escalators*, the material is divided into four parts and has six appendixes.

The introduction includes personal safety, inspectors' duties, etc. Part I covers inspections from inside the car, outside the hoistway, from top of car, in the pit and overhead; electric, belt-driven and hydraulic-machine inspections; and inspection of handrope and slack-cable devices. Part II, which deals with initial or data inspections, includes test procedures, speed-load tests, car-safety tests, counterweight-safety tests and 30 other items that require initial checking. Part III gives procedure for inspection of escalators. The appendixes include suggested inspection-data forms, tables, rope constructions, layouts of car safeties and governors and the handling and socketing of wire rope.

The book is practical, easily understood, **and will be helpful to everyone interested** in elevators and escalators.

Induction Motors

REPAIR SHOP DIAGRAMS AND CONNECTING TABLES FOR LAP-WOUND INDUCTION MOTORS (*second edition*—1946). *By Daniel H Braymer, late editorial director of "Industrial Engineer," and A C Roe, engineer, manufacturing and repair department, Westinghouse Electric Corp.* 387 *pp*, 6x9, 182 *illust*, 52 *tables*, 78 *charts, cloth.* $3.50. *McGraw-Hill Book Co*, 330 *W 42nd St, New York* 18, *N. Y.*

When connecting up induction-motor windings the main job centers around proper grouping of the coils and arranging these groups in a complete winding. This book provides a practical step-by-step guide for repair men and armature winders to lay out coils for induction-motor windings and to connect the end of the coils in proper sequence of pole-and-phase groups, for different type of windings, used in 2- to 24-pole and 2- and 3-phase motors. The material can also be used when reconnecting windings to satisfy changes in voltage, phases or frequency, or a combination of these.

Each diagram is a practical shop drawing marked with proper connections for the ends of all pole-phase groups of coils so they can be followed by the winder when making the connections. All diagrams are accompanied by coil-grouping tables and charts that indicate the number of coils per pole-phase group for different numbers of coils in a winding. In addition to the general index a coil-connecting-diagram index is provided from which any connecting diagram in the book can be readily located. For those interested in polyphase induction-motor winding diagrams this book contains a wealth of practical data.

Water Conditioning

BETZ HANDBOOK OF INDUSTRIAL WATER CONDITIONING 171 *pp*, 8x11, *charts, diagrams, photos*, $1. *By chemical engineering staff of W H & L D Betz, Gillingham & Worth St, Philadelphia* 24, *Pa.*

Thousands of boiler operators and others concerned with water conditioning will find this book a most useful addition to their libraries.

Neatly printed and illustrated in two colors, this publication is for study, reading and reference. It has 54 chapters, divided into two sections. The first, "Water Treatment," contains detailed discussions of the chemical and mechanical processes available for the treatment of water for industrial use, covering such subjects as coagulation, filtration, lime-soda softening, anion exchange, silica removal, boiler scale formation, embrittlement, slime and algae control, etc. The second section "Water Analysis," deals with the impurities in water, how they originate, how they can be removed and methods of analyses suitable for plant control.

Machine Tools

MACHINE-TOOL WORK—FUNDAMENTAL PRINCIPLES (1945) *By William P Turner and Halsey F Owen.* 364 *pp*, 5½x8½, *illust, cloth.* $3. *McGraw-Hill Book Co*, 330 *W 42nd St, New York* 18, *N. Y.*

First published in 1932 and now extensively revised, this book was designed primarily as a guide in connection with a university course of instructions in machine-tool work.

While the material is somewhat elementary, men in industry with machine-shop training, particularly the younger ones, will find the book of value for reference.

Ball and Roller Bearings

BALL AND ROLLER BEARING ENGINEERING (1945) *By Dr Arvid Palmgren*, 270 *pp*, 7x10, 900 *illust and tables, cloth.* $1.75 *SKF Industries, Inc, Front St & Erie Ave, Philadelphia* 34, *Pa.*

Here is a fundamental text on all phases of ball- and roller-bearing applications to industry. It opens with a technical description of common bearing designs and continues through nine chapters of fundamental engineering studies. Both radial and thrust

(*Continued on page* 156)

From End to End of Power Piping
Uniform Quality Stands Guard

Can you say that for your power plant? . . . process piping? . . . or heating system? If the answer is no, take special note of the three-way advantage you get in choosing piping materials from the world's greatest line—Crane.

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ONE RESPONSIBILITY
ONE SOURCE OF SUPPLY

For any piping system—for any working conditions—a single order to your Crane Branch or Wholesaler covers everything required for the installation. Not only the valves and fittings in brass, iron, or steel, but all the pipe, piping accessories, and fabricated piping.

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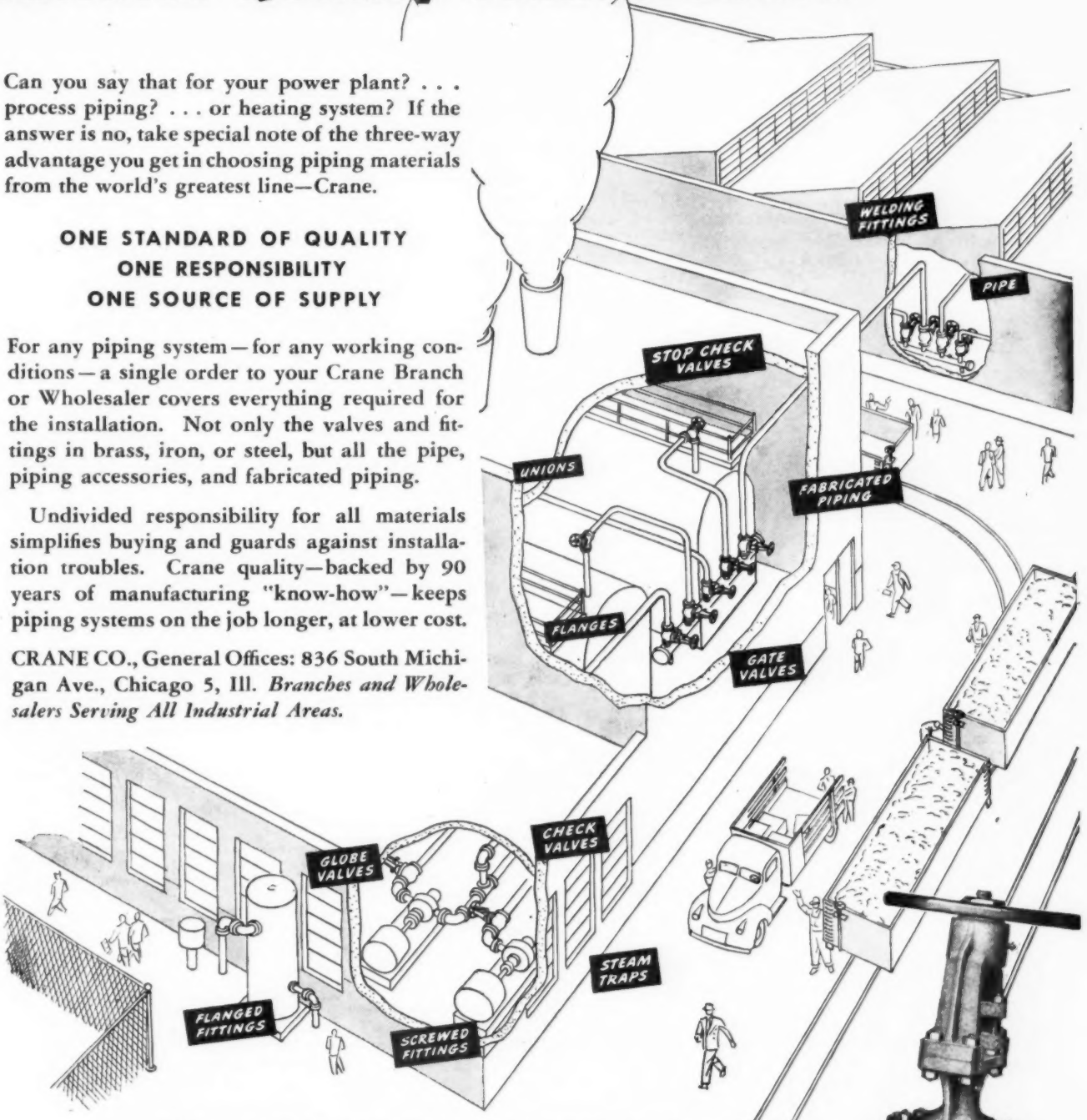

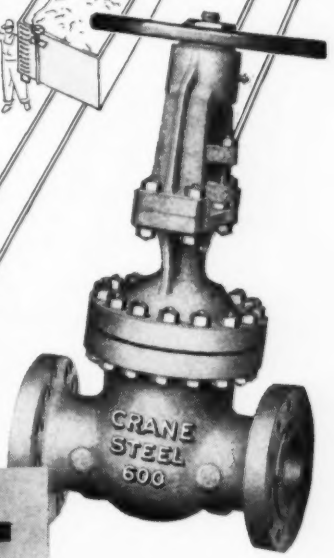

(*Right*) Typical of the uniformly high quality in Crane products—Crane Alloy Steel Wedge Gate Valves. The 600-pound class, with Exelloy to No. 49 Nickel Alloy seating, is recommended for steam, water, gas or air up to 850° F. maximum; with Stellite to Stellite, for steam up to 1000° F.; with Exelloy to Exelloy, for oil or oil vapor up to 1100° F. Screwed, flanged, or welding ends. See your Crane Catalog for complete specifications.

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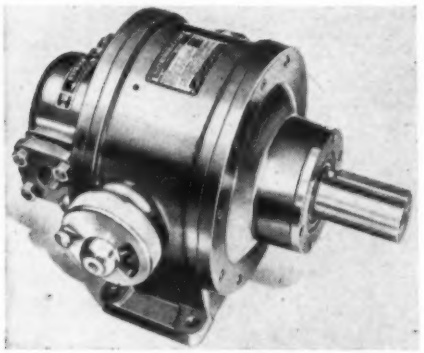
Hydraulic Pump

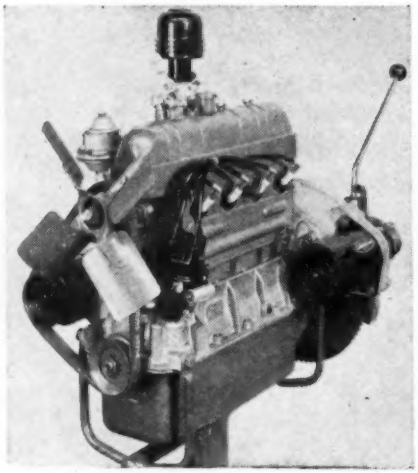
SUPERDRAULIC PUMP of simple compact design, in models light enough for a man to handle, with a continuous-duty development of 5000 psi and 40 hp, delivers 0 to 17 gpm



at 1200 rpm. Pump is claimed to: (1) generate desired tonnage for hydraulic presses and cylinder-actuated machinery without large and expensive cylinder assemblies (2) provide a single source of high pressure and high volume, which in many circuits eliminates cost and complication of a double-pump arrangement (3) provide an instrument for hydraulic production-test equipment and for experimental test equipment (4) eliminate costly intensifiers and accumulators in hydraulic circuits up to 5000 psi (5) provide new hydraulic products dependent upon a compact hydraulic generator of extreme pressure and high volume. **Superdraulic Corp, 12825 Ford Rd, Dearborn, Mich.**

Pipe Coupling

ALL-FLEX BALL-BEARING swivel pipe coupling conveys fluids under high pressure through a pipe which swivels or rotates a full 360 deg. Combination of multiple synthetic packings and metallic seals offers protection against leakage at high and low pressures. A double row of ball bearings, plus metal-backed packings, is said to give the lowest possible resistance to rotation, permitting ease of operation at all pressures. Coupling has a low torque—2.5 in.-lb at 1500 psi and 9.6 in.-lb at 3000 psi. It is preferably made of steel and available in sizes from ⅛ to 1 in. nominal tube size with a variety of threaded and elbow connections to meet particular applications. **Snyder Sales Corp, 5225 Wilshire Blvd, Los Angeles 36, Calif.**



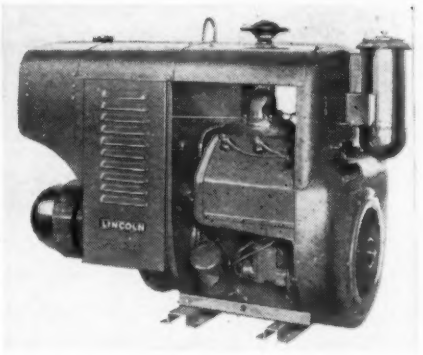
Gasoline Engine

LIGHTWEIGHT GASOLINE ENGINE differs radically from conventional units in use of thin sheet-steel stampings, copper-brazed together, instead of forgings and castings. The 2½x 2¼-in. 4-cyl engine develops 26 hp continuously at 5200 rpm and weighs, bare, 58 lb. Cylinder block consists of light-walled alloy-steel tubing for cylinder and cam-follower guides and of sheet-steel stampings for heads, intake and exhaust ports, valve cases and water jackets.

A 4-cyl block comprises about 120 stampings, which are held together by shrink fits, spot welds or crimping, to form a rigid structure, and then copper-brazed. Only ½ lb of metal is removed in machining the block which previously weighed 14.8 lb. The crankcase is a permanent-mold aluminum-alloy casting; hold-down bolts extend through the case to main-bearing caps. The crankshaft is a high-strength iron casting with induction-hardened bearings. Designed to meet Navy specifications and used in war work, the engine will power the 1946 Crosley car and be available for various applications. **Crosley Motors, Inc, Spring Grove Ave & Alfred St, Cincinnati 14, O.**

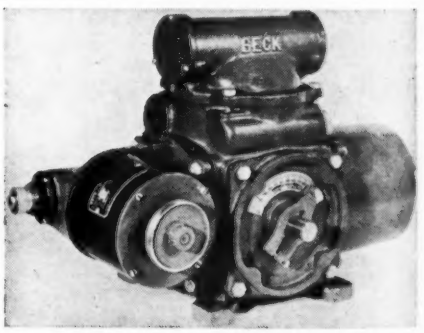
Steel Valves

MANUFACTURER ADDS steel *Weldvalves* in gate, globe and angle designs, 600- to 2500-psi standards, to *Hancock* valve line. These *Weldvalve* designs eliminate or neutralize valve joints, seat-ring joints, bonnet joints, and improve packing-gland joints. *Weldvalves* are said to effect savings in weight, space, parts, replacements, maintenance and lagging expense. **Manning, Maxwell & Moore, Inc, Bridgeport 2, Conn.**



Portable Welder

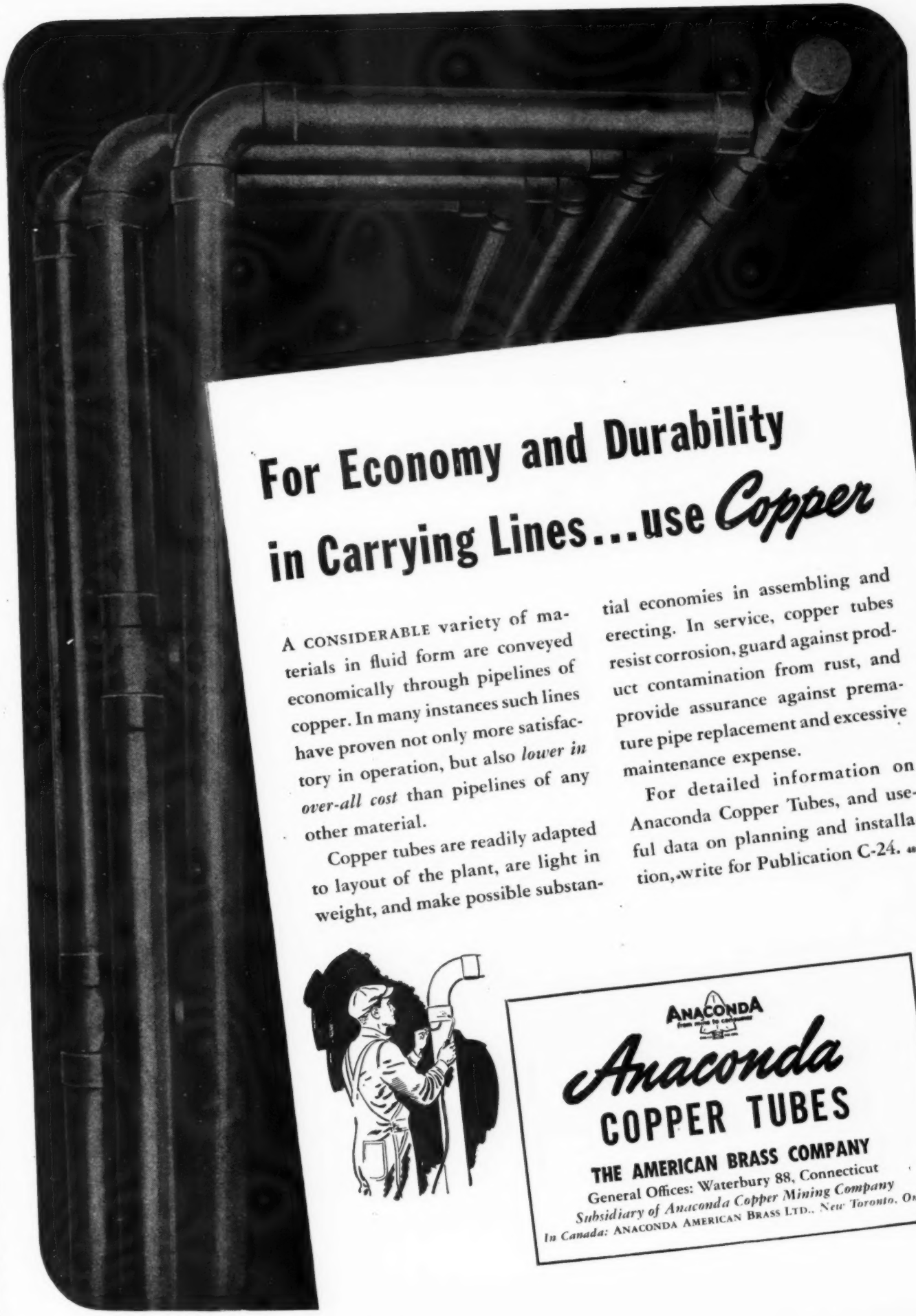
OF PARTICULAR VALUE for areas where electric power is not readily available, gasoline engine-driven welder, known as *Shield-Arc Jr*, is compact and lightweight. Welder measures 24x48x30 in. and weighs 660 lb net. With a current range of 40 to 250 amp, machine welds light or heavy-gage metal, repairs cast-iron structures such as engine blocks, helps construct various contrivances, repairs or fabricates tools and machinery parts. It also serves for hard-facing of worn parts. **Lincoln Electric Co, Cleveland 1, Ohio.**



Automatic-Control Actuator

BECK MECHANISM operates valves, rheostats, autotransformers and similar devices. It makes close control possible under rapidly changing loads, according to maker, holds temperature or other conditions to an exact control point free from the drooping characteristic and permits operation at maximum sensitivity. Mechanism is driven by a slow-speed high-torque noncoasting Beck control motor.

Beck control system is based on three control actions: C-1 is proportional to and opposes any change of controlled condition within throttling range. If this were the only



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A CONSIDERABLE variety of materials in fluid form are conveyed economically through pipelines of copper. In many instances such lines have proven not only more satisfactory in operation, but also *lower in over-all cost* than pipelines of any other material.

Copper tubes are readily adapted to layout of the plant, are light in weight, and make possible substantial economies in assembling and erecting. In service, copper tubes resist corrosion, guard against product contamination from rust, and provide assurance against premature pipe replacement and excessive maintenance expense.

For detailed information on Anaconda Copper Tubes, and useful data on planning and installation, write for Publication C-24. ADV.

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Subsidiary of Anaconda Copper Mining Company
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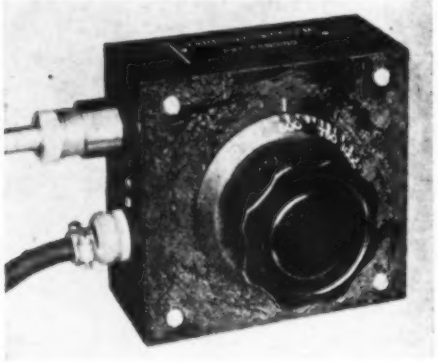
control action, a return of the conditions to control point would place the regulating device in the position from which it started and, on a sustained-load change, continuous hunting would result, or if the throttling range were corrected to avoid hunting the process would settle down at some value off control point. C-2 and C-3 are the automatic reset or droop correctors which eliminate this effect. **Harold Beck Co, 3644 N 2nd St, Philadelphia 40, Pa.**

Discharge Check Valve

DESIGNED TO GIVE positive protection against backsurge of discharge lines carrying steam, sludge, waste water and other waste liquids. in gravity-flow installations, discharge check valve may be operated with or without a manual control or with an extension shaft or flexible cable from an access box.

To assure nonfouling of valve, unit has a swing check flap suspended from a full-floating pin fulcrum to insure positive full-surface contact between ground face of flap and flap seat. Swing check flap suspended from cover can be removed easily and replaced.

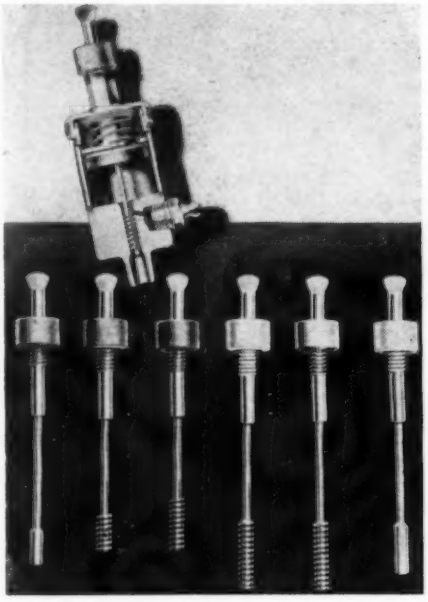
Flanges are 150 lb, flat faced and blank or drilled as specified. Valves are available with 180-, 105- or 90-deg bodies of cast bronze, steel, semisteel, cast iron and alloyed metals for corrosion resistance. **J A Zurn Mfg Co, Erie, Pa.**



Remote Control

FLECTROL APPLIED to commercial speed changers provides fingertip remote control of speed. The dial can be set instantaneously to any desired speed and the speed changer will follow as fast as the electric servomotor can drive the speed-adjusting screw. The dial can be calibrated in rpm, fpm, gal per hr, etc. No other speed-indicating devices are required.

In operation, *Flectrol* controls rotation of the small motor used to adjust pulleys or gears of speed changer. Rotation of the speed-selector dial causes this motor to drive the adjusting screw until output speed of controlled device corresponds to speed selected on dial. Photo shows *Flectrol* applied to a *Reeves*, size 00, horizontal, inclosed speed changer. Remote control is simple, rugged and compact; it is applicable to new or existing equipment of any type. Besides being applied to speed-changing equipment, it may also be built in or added to all equipment having motor-operated adjustment. **Yardeny Laboratories, Inc, 105 Chambers St, New York 7, N. Y.**



Lubricators

DESIGNED IN FOUR SIZES, with lubricant capacities ranging from ½ to 8 oz, pressure-filled *Gun-Fil* lubricators automatically dispense oil or grease in a measured, uniform flow to a moving bearing and stop feeding lubricant when a bearing becomes motionless. Six interchangeable valves are available with distinctive colored caps for identification. The valves with colored caps exert varying degrees of control of feed on greases of different densities. By feeding precise amount of lubricant to each individual bearing, according to its needs, *Graco Gun-Fil* lubricators offer dependable bearing lubrication. **Industrial Div, Gray Co, 60 11th Ave, NE, Minneapolis 13, Minn.**

Transmission Equipment

GREAT STRENGTH and shock resistance are said to characterize the fabricated-steel construction of new miter gear boxes and brackets. Extra-long hubs provide for large self-lubricating *Oilite* bearings and oil reservoir plus a convenient place for support of gear box by the clamp brackets which are designed to allow line-up in one place during installation. Oil-sealed and plain models are offered in shaft sizes ranging from ½ to 1½ in. dia.

New flexible gear turret connects shafts that form any angle between 0 (straight line) and 95 deg on either side of zero angle. A unique arrangement of bevel gears attached to shafts, which are supported in hinged housings, permits shafts to oscillate and rotate simultaneously. Horsepower capacities are based on the Lewis formula and are consistent with standard power-transmission practice for shafts ranging in size from ¾ to 1½ in. dia. Two kinds of brackets are offered for supporting the gear boxes.

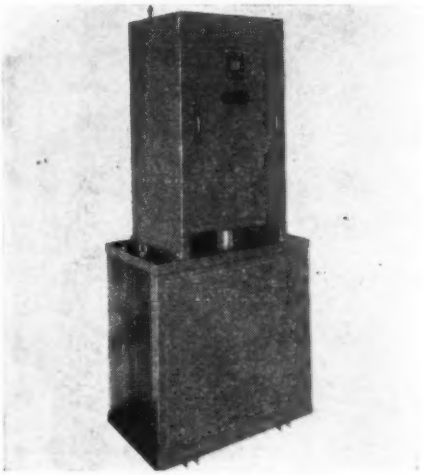
Universal joint employs a device which provides a positive lock for the pins, and a convenient method of disassembly. For convenient handling this steel joint is rust-proofed and individually packaged. **Brooks Equipment Corp, 217 Hudson St, Hoboken, N. J.**

Magnetic Coupling

COMPACT IN DESIGN, magnetic coupling permits installation on small-diameter submersible deepwell pumping units ranging up to 200-hp capacity. The true magnetic feature allows no slippage and operates at low-energy input. **Sealed Motors Corp, 50 Church St, New York, N. Y.**

Renewable Switch

FOR MOTORS OR RESISTIVE LOADS such as heaters or lamps, renewable switch is rated at 15 amp, 110 v, ac. This switch can serve in a single-hole mounting. Protruding out the back are two flat studs to which lugs frequently are attached. However, when switch is used as a renewable type, the studs slide down between two contact bars in the back part of the cradle. Front part of switch slides down through a slot in front part of cradle, which is attached to any flat surface by countersunk screws. At present, only single-pole single-throw switches, either normally open or normally closed, can be furnished in this renewable design. **Robert Hetherington & Son, Inc, Sharon Hill, Pennsylvania.**



Power-Factor Regulator

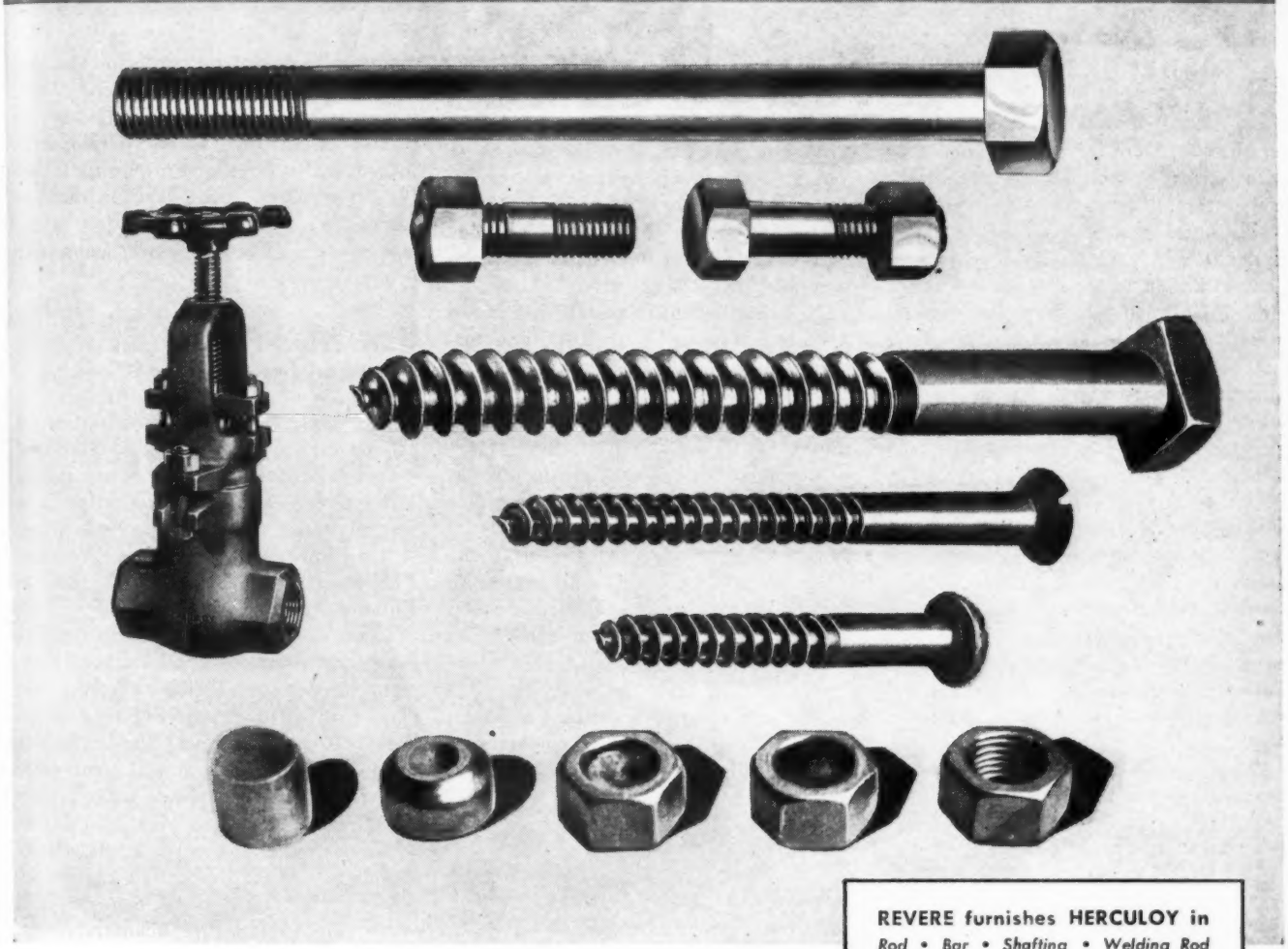
EMPLOYING HAUG SYSTEM of control, power-factor regulator relieves generator of the work of supplying magnetizing current. It also provides improvement in voltage regulation. It eliminates necessity of building a new power line or installation of new feeders should greater power demands become necessary. However, the chief advantage is claimed to be a greatly reduced monthly power bill and a substantial saving in man-hours because of greater line stability and apparatus efficiency. Reactors and transformers are of

(*Continued on page* 188)

REMEMBER THAT HERCULOY OFFERS THE ELECTRICAL INDUSTRY

• THE STRENGTH OF MILD STEEL

• THE CORROSION RESISTANCE OF COPPER



HERCULOY is the name applied to improved copper-silicon alloys made by Revere. These alloys have the strength of mild carbon steel, plus the corrosion resistance of copper, and hence are exceedingly valuable in stressed parts subject to corrosive influences such as moist air, sea water, contaminated or corrosive natural waters, and industrial wastes, many of the acids, alkalis and other process chemicals.

In the electrical industry, Herculoy bolts, nuts, washers, U bolts, lag and wood screws and similar parts have found wide application in transmission lines, construction of catenary suspensions for electric railroads, and in power plants and substations. In steam plants Herculoy has found a great variety of uses, including packing gun cylinders for expansion joints, shafting for water pumps, valves and valve stems.

Herculoy can be easily hot or cold worked, drawn, welded, spun, stamped, machined and otherwise manipulated by standard methods. To benefit to the utmost from these high-quality Herculoy alloys, consult Revere.

REVERE furnishes HERCULOY in

Rod • Bar • Shafting • Welding Rod
Sheets • Plates • Rolls • Strips • Tube
Ingot
for
Bolts • Nuts • Screws • Nails • Guy Clamps • Bus Fittings • Clevises • Line Hardware • Tanks • Pressure Vessels Kettles • Boilers • Screens • Blowers and Fans • Pumps • Valves • Piping for Water, Oil, Chemicals

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POWER NEWS

BUSINESS ITEMS AND APPOINTMENTS • WASHINGTON NOTES

FOREIGN FIELDS • MODERNIZATION POINTERS • CONVENTIONS

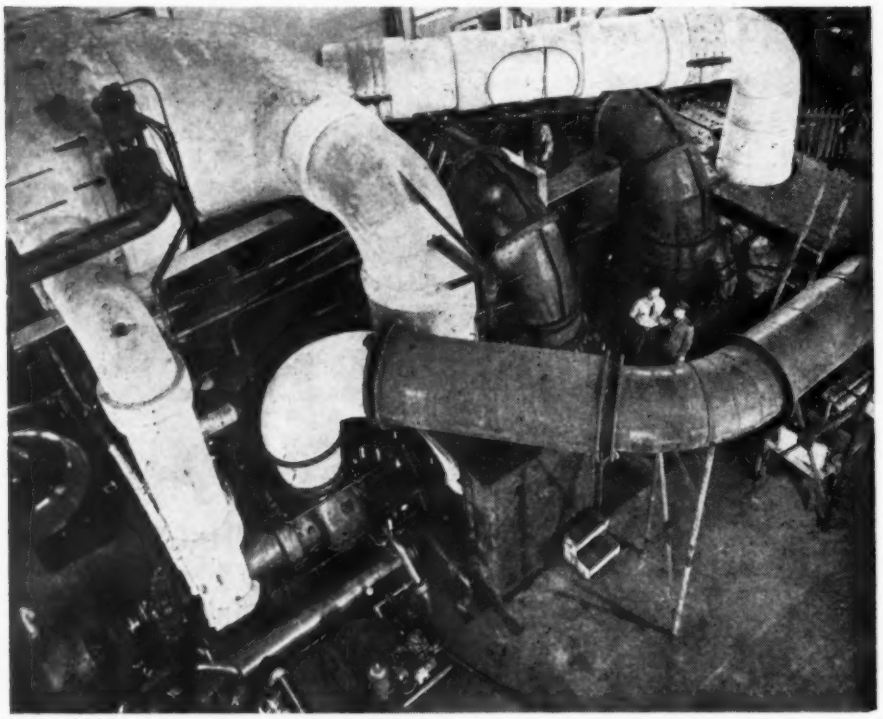
Annapolis Experimental Gas-Turbine Plant

▶ SUCCESSFUL OPERATION at a gas temperature of 1350 F has been accomplished in a series of successively increasing temperature tests on an Allis-Chalmers' experimental gas-turbine plant installed in the U. S. Naval Engineering Experimental Station at Annapolis. Designed and built by Allis-Chalmers for eventual operation with gas at a temperature of 1500 F, the 3500-hp unit is the first large multistage gas turbine for continuous power generation at high efficiency ever operated successfully at such high temperature.

Although this gas turbine has been developed as a Navy project, its basic elements have characteristics suitable for land and marine practice. Numerous mechanical, metallurgical and fluid-flow problems have already been overcome, and much has been determined about operating characteristics of the turbine and compressor in completed stages of the test program.

The multistage turbines in this installation are designed for high efficiency. The Annapolis unit embodies innovations in cooling methods, permitting the multistage turbine to operate safely at high-inlet temperature by avoiding undue weakening effect of high temperature on materials for rotating parts.

Gas-turbine plant is arranged with two turbines operating in parallel, one turbine supplying the power required to drive the compressor, the second turbine furnishing power necessary to satisfy requirements of the driven machine or dynamometer. Compressor unit operates at a speed commensurate with lowest possible fuel consumption. The 40,000-cfm compressor discharges at 45 psi to the regenerator where it picks up heat from the turbine exhaust gas. Heated air then passes through two oil-fired combustion chambers where it is further heated to desired turbine-inlet temperatures. Gas then expands in two multistage turbines. One supplies power to drive compressor; the other furnishes external shaft power.



This 3500-hp experimental gas-turbine plant at Annapolis was designed and built by Allis-Chalmers for eventual operation with gas at a temperature of 1500 F

Careful to point out experimental nature of the Annapolis gas turbine, Allis-Chalmers nevertheless indicates in its references to this major development project that it foresees a promising future for gas turbines, particularly in railroad locomotives, aircraft propulsion units, marine and electric power-generation prime movers.

New Wind-Power Unit Planned for Vermont

To explore further the possibilities for use, on a commercial scale, of wind-generated electricity, a new corporation, Windpower, Inc, has recently been formed under the presidency of Albert A Cree, president of Central Vermont Public Service Corp and co-trustee of Rutland Railroad.

The first step will be to erect, on a high summit in the Green Mountains of Vermont, a redesigned 1500-kw capacity Putnam wind turbine to feed power to the lines of Central Vermont Public Service Corp. Proposed turbine will incorporate knowledge and experience gained from five years' study of original test installation at Grandpa's Knob, Castleton.

Palmer Coslett Putnam of Boston, inventor of Putnam wind turbine and chief consultant for the experimental project, will be a director of the new company. During the war years, Mr Putnam was associated with Dr Vannevar Bush, director of Office of Scientific Research and Development. He was responsible for design of amphibious vehicles and later, as technical adviser to commanders in various theaters, supervised development of new amphibious tactics.

While erection of this second unit will be undertaken primarily as a scientific and commercial project, it is tentatively planned that the huge wind turbine will become the focal point of a complete scenic and recreational mountain-top development, including a toll road, summit restaurant and small hotel, and possibly a ski development. The continuously rotating blades of the turbine will have a span of more than 200 ft and will be night-lighted as a landmark and guide to aviators.

(*Continued on page* 162)

remember the "One Shot" WATER TREATMENTS?

MOST of us remember the one-shot treatments that were supposed to cure any and all water treatment problems. A few are left, but the Nalco-pioneered method of scientific analysis and treatment for individual plant problems has generally replaced the hopeless search for a single chemical that is all things to all plants. The only worthwhile miracle in modern water treating is the complete and permanent solution of each plant problem . . . a Nalco specialty with a definite answer for your plant.

...asks Otto L. Hudelik

Nalco Representative, Portland, Oregon

Nalco

NATIONAL ALUMINATE CORPORATION

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Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Ave., Toronto, Ont.

THE SYSTEM OF SCIENTIFIC WATER TREATMENT FOR ALL INDUSTRY

How to plan a

HIGH PRESSURE STEAM DISTRIBUTION SYSTEM

Another in the series of basic Piping Layouts prepared by Jenkins Bros.

High Pressure Steam Distribution Systems of the type illustrated in this layout are frequently installed for the efficient heating of the sprawling, monitor type industrial plants, covering a large area, which have been built in increasing numbers during the past few years. The hookup allows for reduced pipe sizes and takes care of excessive pressure drops due to the long distance between the heating plant and the radiation.

Substantial savings in installation and maintenance costs are effected through the elimination of return lines in many such installations, especially where the heating system takes a small percentage of the steam and treated water. Condensate is collected in vented tanks at the lowest points in the system, and drained off. Check valves prevent back flow from the tanks.

In the 100 pound steam system shown here, reducing valve stations with a safety valve and manual bypass are installed at each piece of heating equipment. A conventional drip connection from the high pressure feed line to either the low pressure line or to the return line is shown, allowing for a choice of dripping by closing either of the valves marked "E". Should both of these valves be left open in error, no damage would be caused other than the loss of steam.

Bronze Globe Valves of the renewable composition disc type are recommended for all shut-off and bypass lines to assure lasting drop-tight service. On steam returns, regrinding type Bronze Check Valves with 45° seats will remain tight; even at extremely low pressures, to prevent opening and seepage from back flow.

Jenkins PRACTICAL PIPING LAYOUTS

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

1. **Use the right type valve for the service.**
2. **Place valves correctly in the line.**
3. **Choose Jenkins Valves for lifetime economy.**

9

Fig. 92
Regrinding
BRONZE SWING CHECK VALVE
125 lbs. Steam 250 lbs. O.W.G.

Several Types and Pressure Ranges of Jenkins Valves, other than those shown, can be used for this type of layout, according to the factors involved. Consultation with accredited piping engineers and contractors is recommended when adapting these suggestions to your own requirements, or when planning any major piping installation.

Copies of Layout No. 9 will be furnished on request . . . also copies of future Piping Layouts. Just fill out and mail the coupon.

Fig. 92, the Bronze Swing Check Valve recommended in this layout, is particularly serviceable for the non-return control of steam up to pressure of 125 lbs., and non-shock cold oil, water, and gas up to 250 lbs. The high tensile bronze disc is carefully machined to a smooth, tight-fitting finish, and can be reground easily without removing the valve from the line.

A CHOICE OF OVER 600 JENKINS VALVES

To save time, to simplify planning, to get the advantage of Jenkins specialized valve-engineering experience, – select all the valves you need from the Jenkins line, fully described in the latest Jenkins catalog, No. 76. It's your best assurance of the *lowest cost in the long run.*

JENKINS VALVES

LOOK FOR THE DIAMOND MARK
SINCE 1864

TRADE JENKINS MARK

125 TO 600 LBS. PRESSURE

Jenkins Bros.

BRONZE ★ IRON ★ STEEL

FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE
SOLD THROUGH RELIABLE INDUSTRIAL DISTRIBUTORS EVERYWHERE

VALVE RECOMMENDATIONS

For details – and valves to suit varying conditions – see Jenkins Catalog.

Code	Quantity	Jenkins Valves	Service
A	5	Fig. 106-A Bronze Globe	H.P. Shut-off
B	4	Fig. 106-A Bronze Globe	L.P. Shut-off
C	2	Fig. 106-A Bronze Globe	Free Blow
D	2	Fig. 106-A Bronze Globe	Trap Test
E	2	Fig. 106-A Bronze Globe	Drip Shut-off
F	2	Fig. 106-A Bronze Globe	Manual By-Pass
G	2	Fig. 168 Angle w/Union	Radiator Shut-off
H	6	Fig. 92 Swing Check	Steam Return
I	1	Fig. 167 Globe w/Union	Radiator Shut-off

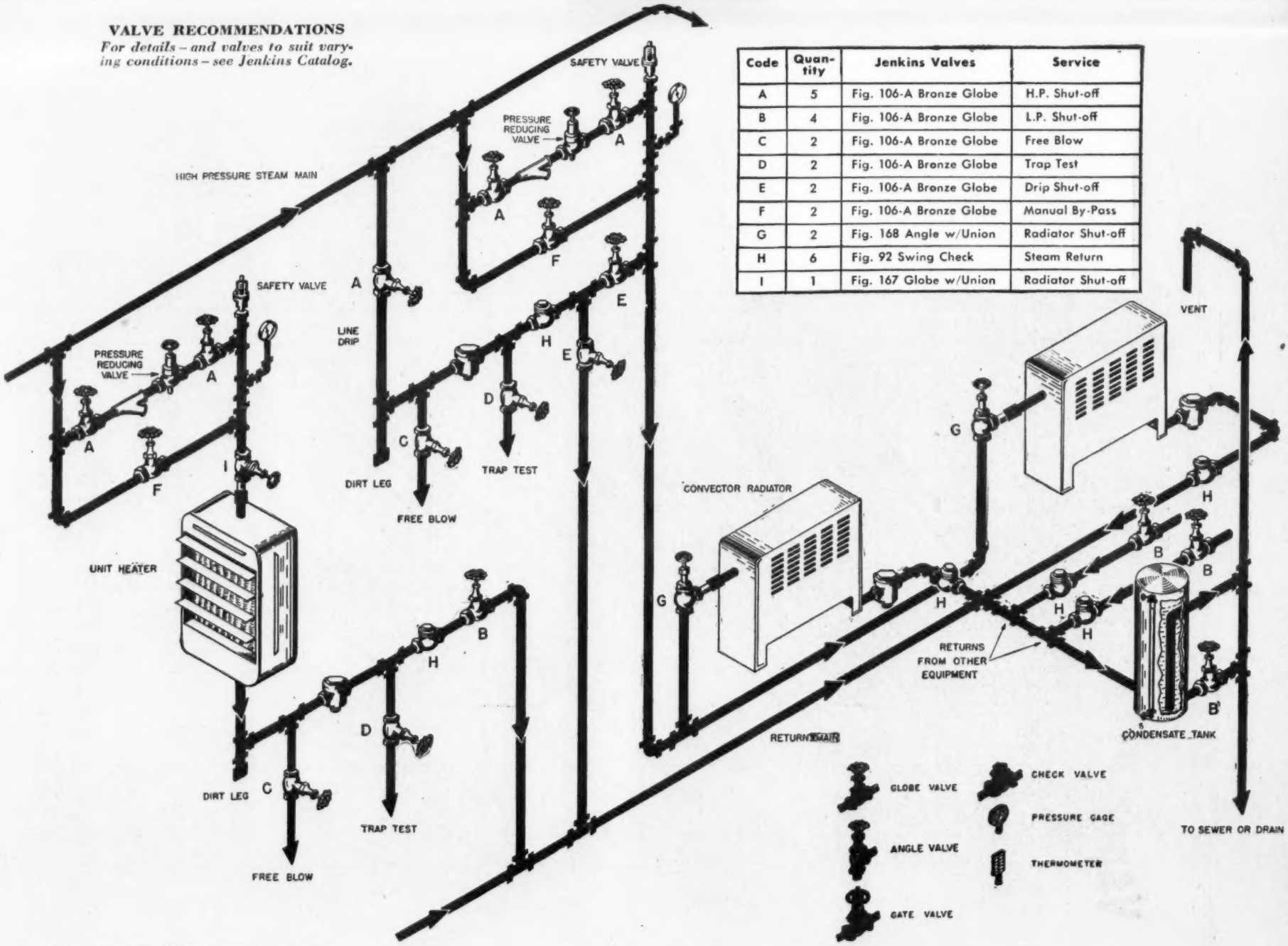

Diagram by Huxley Madeheim, Consulting Engineer

HIGH PRESSURE STEAM DISTRIBUTION SYSTEM

JENKINS BROS., 80 White St., New York 13, N. Y.

Please send me a reprint of Piping Layout No. 9 and future Layouts as they become available.

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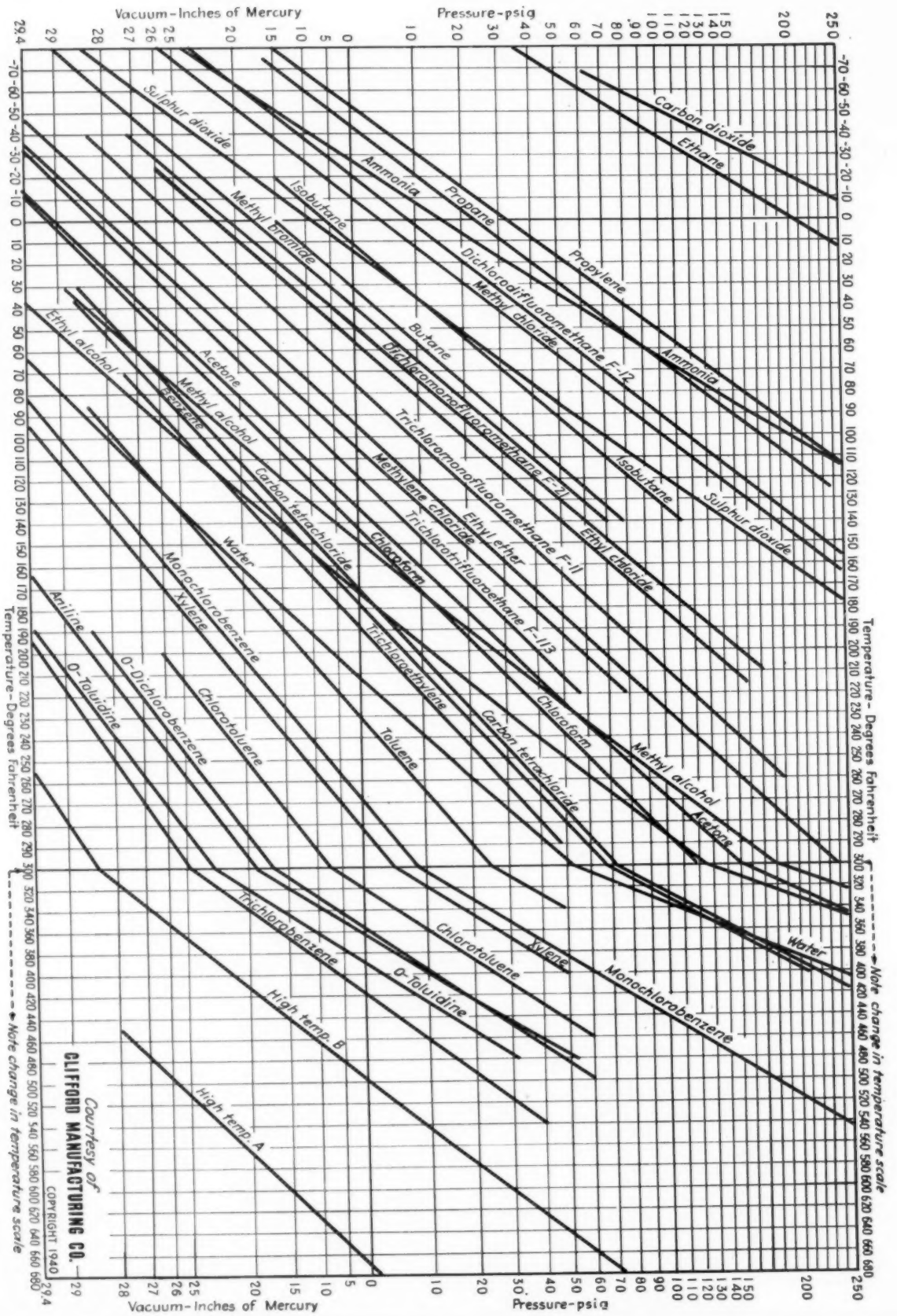
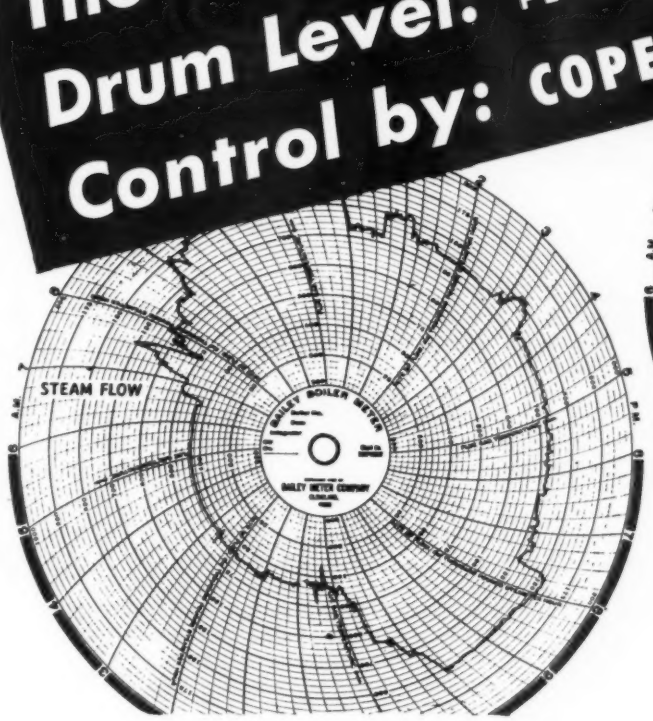
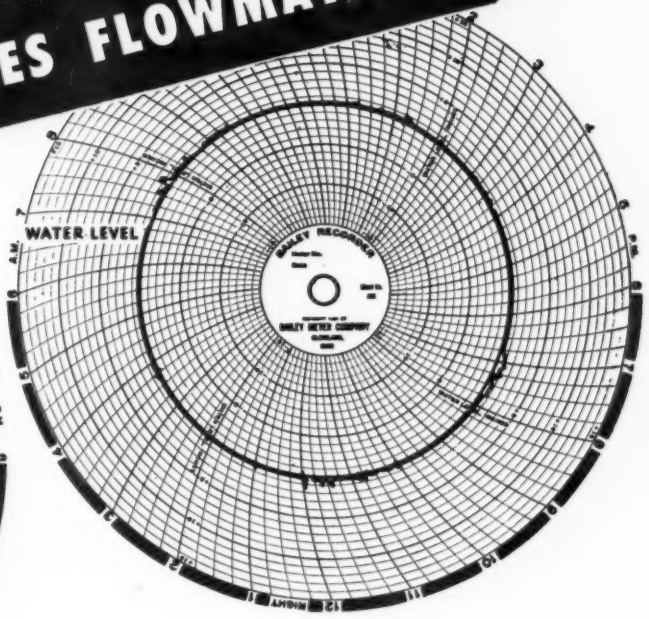
Number 164

Vapor Pressure—Temperature Curves



The Boiler: ERIE CITY 3-DRUM, 675 PSI
Drum Level: PLUS-OR-MINUS 3/4-INCH
Control by: COPES FLOWMATIC





If you want proof of performance, check these charts. They came from one of the two 675-psi boilers, each rated at 185,000 pounds per hour, in an Eastern utility plant. There is no pressure control on the three constant-speed motor-driven centrifugal boiler feeders, each of which has a capacity of 445 gpm at 875 psi. This means there are wide changes in the differential water pressure as the boiler load varies, but the COPES Flowmatic automatically compensates for such pressure changes.

Except for momentary "shrink" and "swell" during large load changes, the drum level is held within plus-or-minus ½-inch. Greatest level change recorded was 1½ inches between 7:30 and 8 a.m., when the load swung rapidly from 125,000 to 75,000 and back to 100,000 pounds per hour. Adjustment of the COPES Flowmatic is for a practically-constant level, although it could easily be changed to give either a rising or a lowering characteristic, if this were the operating preference.

The story of this installation is told in Bulletin 445. A request on your letterhead will bring you a copy. And when you write, outline your operating conditions. Find out how COPES Flowmatic might improve them.

NORTHERN EQUIPMENT COMPANY
461 Grove Drive, Erie 6, Pennsylvania

Feed Water Regulators, Pump Governors, Differential Valves, Liquid Level Controls, Reducing Valves and Desuperheaters

BRANCH PLANTS: Canada, England, France.
Representatives Everywhere

★ GET CLOSER LEVEL CONTROL WITH THE COPES FLOWMATIC ★ REGULATOR
FEEDS BOILER ACCORDING TO STEAM FLOW-AUTOMATICALLY

Town Meeting . . .

New England Yankees, strong believers in the rights of every man, have a surefire method of running their affairs. They call it a town meeting, where the whole town gathers every so often to talk over their mutual business. There the mill owner, the butcher and the garbage collector are people just like everybody else, and each has equal right to speak his say. When talking is over, they vote. The majority rules.

That's traditionally the best way to solve mutual problems. A man has to say what's on his mind, "right out in meetin' "; there's neither the excuse nor the opportunity for double talk. It's too bad, in lots of ways, that the United States have grown so big and so complex we can't use the town-meeting method to solve our national—and international—problems.

We try to do the same thing by electing representatives to meet and work things out. But that's where the trouble begins. Small groups offer candidates and use all sorts of devices to get their men nominated and elected. Once in office, the representative must—unless he's very strong—line up with groups in the "representative group" in which he sits. They trade him their votes for his; he is pushed and pulled by pressure bodies and by his own desire for reelection. He evaluates the voices back home on the basis of how many votes they represent, so any organized minority has a voice out of all proportion to its size. And those voices are frequently talking double for their own benefit.

The whole idea of honest talking "before the whole town" gives way to back-alley whispering and across-the-bar deals. Men who talk straight find themselves talking to thin air—because they represent only one vote—unless they mount a soapbox and harangue their fellows on street corners until they get another league, association or committee started to pull "representatives" in another direction.

My purpose in bringing all this up is to suggest that you be sure your opinion is your own—that you aren't pulled along by the crowd or your vote is guaranteed without your full knowledge and consent. We're getting to the point where we ordinary and quiet mortals will have to talk up, to say our own say instead of letting some smooth-tongued word twister do it for us. He always has his own axe to grind, and may monopolize the grindstone if we don't make him take his turn at the handle.

It's a little hard to picture, but I'd like to see the day come when all the millions of us think and talk for ourselves as they do in the Yankee towns. I've got a hunch most of our problems with prices, labor, politics and even international relations would disappear like magic if people talked to people in open meetings.

George Edwards
Engineer

The Stuffing Box

TIPS ON GOOD PACKING PRACTICE

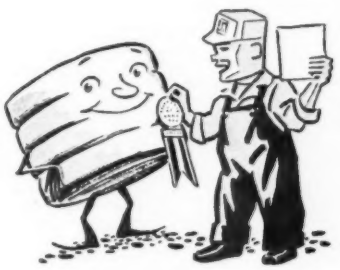
NO. 1 OF A SERIES

One common-sense way to get the best service out of packing and at the same time save wear and tear on equipment is to have the stuffing box inspected frequently. How often this should be done depends on the type and severity of the service. For example, one packing user we know makes a checkup on every shift because his pumps handle highly corrosive fluids and he can't afford to have anything go wrong. It's the old story of "a stitch in time . . ."

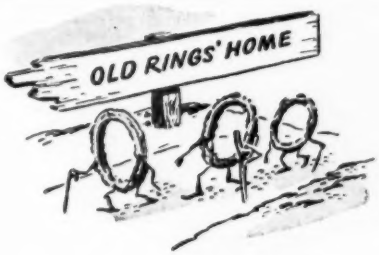
A stuffing box inspection should include these points:

1. Check glands and seals for excessive leakage, adjusting where necessary.
2. Make sure that pistons, rods and plungers run true.
3. See that the gland is pulled up squarely and is not cocked.

Note that we said "*excessive* leakage" under point 1, above. It is good practice to allow a slight leakage where permissible. In the case of newly installed packing, this will allow for expansion and proper seating. It should be remembered that too much gland pressure will cause excessive friction. This not only wastes power, but also increases wear on the moving parts and reduces the life of the packing.



Keeping a "service record" showing the date on which each set of packing was installed and replaced will establish the economic life of the packing. Consult this frequently to make sure the packing is not being used beyond this period. Even though a packing continues to give service it is better practice to replace it, rather than run the risk of damage by waiting until it is completely worn out.



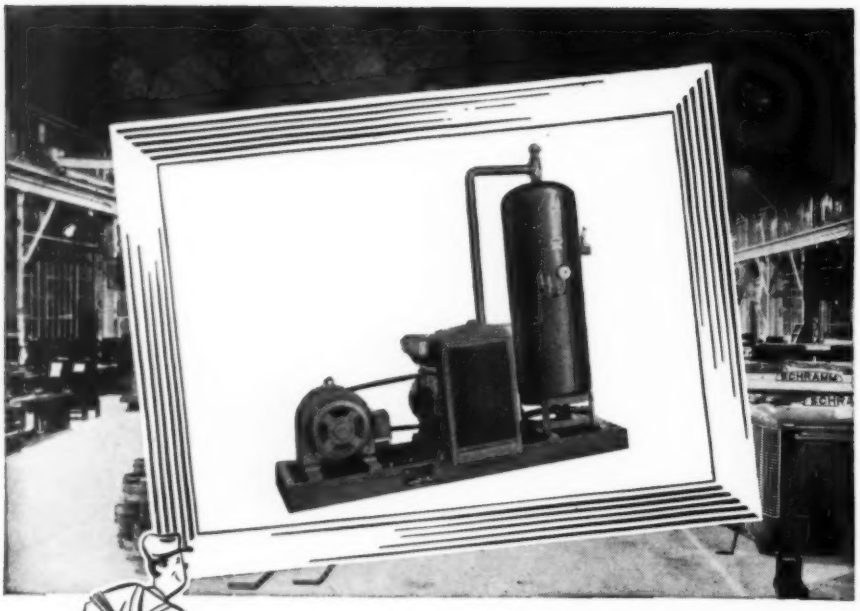
When the gland is "all the way up," it normally indicates that the life of the packing is finished and repacking is necessary. And remember that when you renew packing, it is poor economy to replace just one or two rings. This is like adding a quart of new motor oil to the four quarts of old, worn-out oil in your car. You wind up with five quarts of worn-out oil. Replacing all the old packing is the only way to get a first-class repacking job.

And when you need a packing—there are 400 conveniently located Johns-Manville Distributors ready to supply you with the right one for your job.

A tip on a good packing . . .

JOHNS-MANVILLE SEA RINGS

Unlike ordinary rod and plunger packings, Sea Rings do not depend on gland pressure for proper functioning. They adjust themselves *automatically*—seal on the work stroke, release on the returns thus reducing friction and wear on both packing and rod. To cut *your* maintenance costs, use Sea Rings on your next job. Write Johns-Manville, Box 290, New York 16, New York.



IN AIR COMPRESSORS . . . THERE ARE *Masterpieces, too*

Specialized workers make Schramm Air Compressors with that all-important "Know-How". So, when you get your Schramm Air Compressor you know you are not only getting a compressor with many exclusive features, but you know Schramm workers are assembling the features right, testing them thoroughly, and making a Masterpiece!

Schramm, with its enlarged facilities and modern plant at West Chester, produces on a large scale for industry. Schramm's expert workers and larger, modern facilities are geared to meet your needs for Air Compressors, both portable and stationary, in a wide range of sizes, for any requirements.

Today's features of Schramm Compressors are those that have stood up so well under the test of actual performance. These features include (1) 100% watercooled (2) mechanical intake valve (3) forced feed lubrication (4) main bearings between every cylinder (5) compact and lightweight.

Post-war industry will find many uses for the versatile Schramm Air Compressor. We invite you to write today for our new catalog and become acquainted with the construction features and details of the many Schramm models.

SCHRAMM INC.

THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

Forge-Shop Heating

(*Continued from page* 105)

closed and automatic control. This selector is located on the control board for operating convenience. In the winter when full steam flow is required on the heaters the selector switch is moved to "open," thus taking the control away from automatic operation and assuring steam flow at all times. When the weather is changeable in spring and fall the selector is set at "automatic" so full control can be automatically maintained to save as much steam as possible. In summer when we know steam flow is not required the selector is turned to "closed" to insure against accidentally opening the valves.

We have found this heating system very satisfactory, automatically maintaining as it does discharge air at a fixed temperature, rather than trying to maintain shop temperatures automatically. It holds temperatures in the shop at a more constant rate with less steam because the sudden changes in temperatures are reflected only very slowly into the heating system. About 15 minutes each morning and evening is all the time required to adjust the system. During the winter on weekends, holidays and evenings when the forge shop is shut down, we run the heating system wide open to keep the shop as warm as possible. In the summer we never shut off the fans, thus removing as much heat as possible and keeping the place workably cool and ventilated.

Condenser Tubes

(*Continued from page* 100)

Note that these tubes were not expanded into the packing, although this could have been done, but were only rolled to the proper shape and size. The joints remained as packed joints.

As previously explained, a stop fastened to the mandrel controlled the internal tube diameter. The rolling depth was determined by a stop collar that was integral with the expander body. Both stops were provided with thrust washers, Fig. 1, one to protect the expander body, the other to prevent wear on the condenser tube ferrules when the stop reached its limit.

A universal tapper operating at 250 rpm furnished the motive power for the expander, which is shown in Fig. 1 positioned in the tube and ready for rolling. The tapper is light enough to handle

Here's a Valve You Can Trust in Exposed Locations

CHAPMAN LIST 960

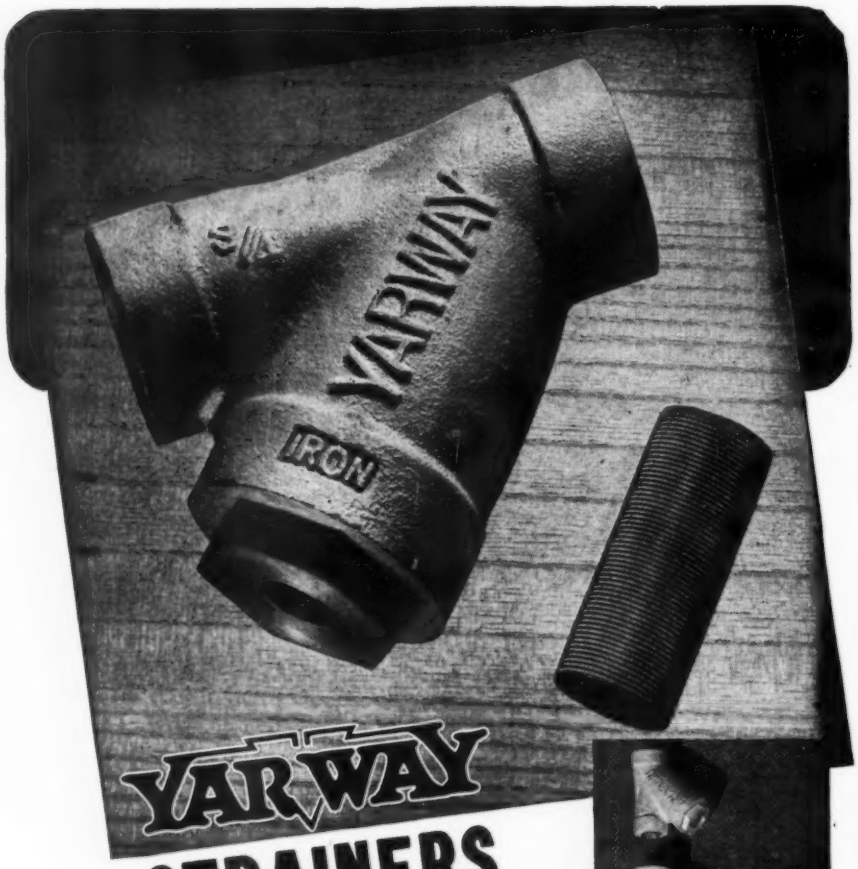
PATENT
NO. 1,866,292

The Chapman List 960 Small Gate Valve is fitted with a flanged forged steel packing gland, which safeguards the threading on the valve yoke against rusting and corrosion when the valves are used in exposed locations. Quick-acting threads open and close easily — will not stick or freeze. Seats and plugs can be superhardened for extra severe services.

Chapman List 960 Valves in sizes from ¼" to 2" — carbon steel for pressures to 800 pounds at 750° F. For higher pressures, specify List 990.

The Chapman Valve Mfg. Company

INDIAN ORCHARD, MASS.



STRAINERS "Police the Pipelines"

YARWAY STRAINERS are *selling by the thousands* because they are better engineered for the service.

"The Screen is the Thing"—a high-grade, woven Monel wire screen that stops the dirt, lets fluids flow freely.

Then, too, purchasers like the *body finish —Cadmium plated* for protection against corrosion and for better appearance.

And last but not least, it is *"Easy to Clean"* having a steel blow-off bushing, precision machined with straight thread. Screen and bushing come out together—go back together, automatically aligning.

Six sizes, ½" to 2" for pressures up to 600 lb serve practically all strainer needs.

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with one hand, leaving the other free to guide the expander.

After rolling is completed, a pull on the handle causes the tapper to reverse, backing the expander out of the tube and making it ready for insertion into the next one. A more detailed description of tapper action as well as that of expanders will be found in the footnote given at the bottom of page 99. The mandrel in Fig. 1 is not a standard one, but is shortened to permit the use of motor-driven tappers in close quarters, for instance, in back of the condenser weirs. Sometimes it may be necessary to use a taper pin in opening up badly necked tubes to admit the expanding tool.

With only a few calls for the taper pin one man reconditions about 800 tube ends in an 8-hr day.

Since solving the leakage on this "problem" condenser, several other units that developed high leakage rates have been treated in like manner, with the same lasting improvement in all cases. This treatment with expanders has also been applied to condensers having necked tubes preventing the passage of cleaning plugs. The necked ends were opened up, plugs removed, and circulation was restored in the tubes.

Another valuable application is to roll the ends of tubes to be removed from a condenser, because the tubes will then slide freely in the joints and permit ready access to the packing.

Pump Q & A

(*Continued from page* 118)

is primed and valves V_1 and V are closed, in that order.

An ejector can be used for a number of pumps if connected to a header to which the individual pumps are vented through isolating valves.

Q 9—*What is a dry-vacuum pump?*

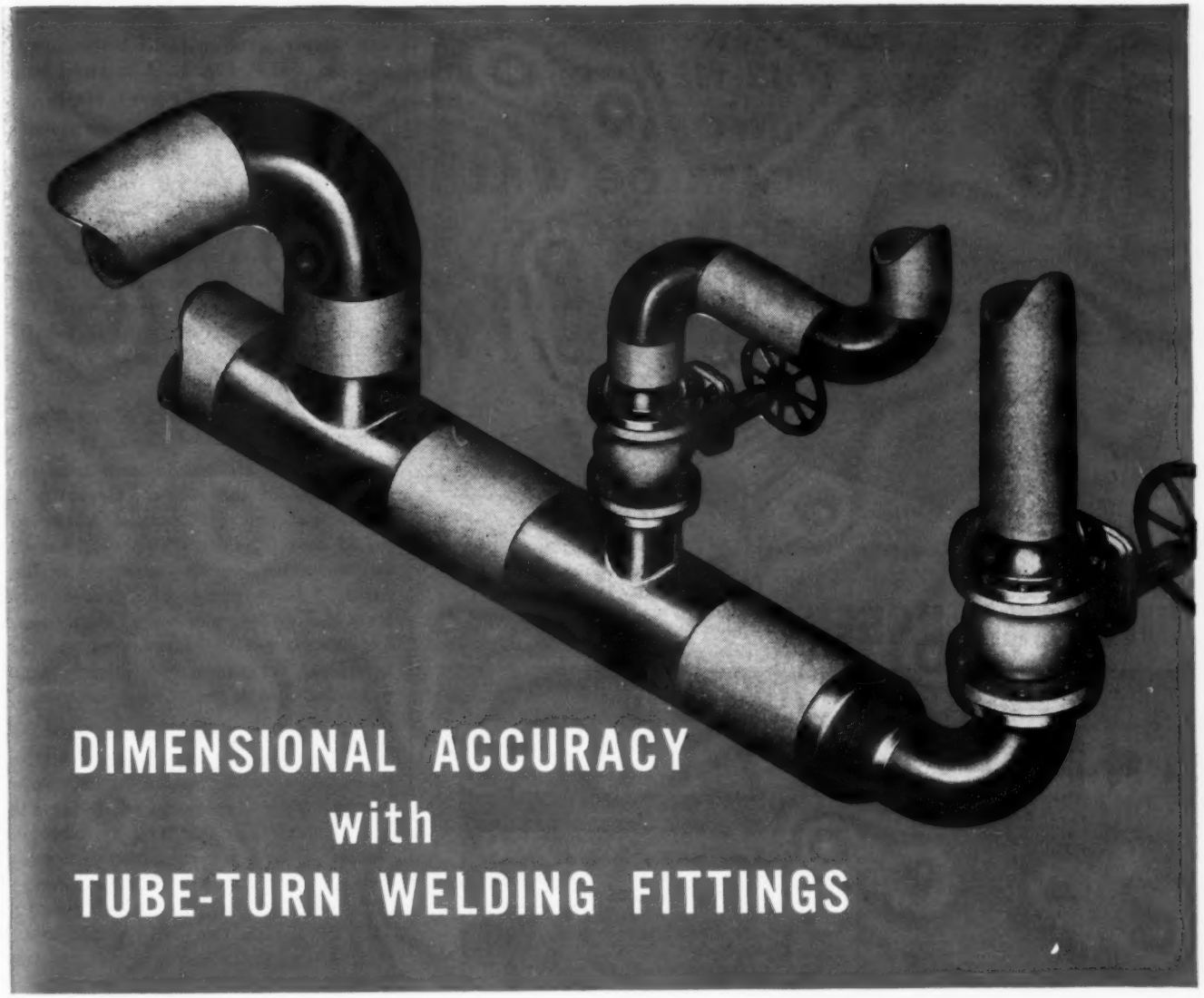
A—It may be either a reciprocating or rotary design that handles air only. For priming purposes, the system is arranged so that liquid cannot get to the vacuum pump.

Q 10—*What is a wet-vacuum pump?*

A—Any rotary, rotating or reciprocating pump that handles air or a mixture of air and water is classified as a wet-vacuum pump.

Q 11—*Are hand-operated priming devices used?*

A—Formerly quite commonly employed to prime centrifugal pumps,



WHEN pipe and fittings agree in O.D., I.D. and wall thickness, alignment from the *outside* brings them into perfect alignment on the *inside* also. The dimensional accuracy of Tube-Turn welding fittings permits installing any pipe line according to design without making allowances for variations in individual fittings.

All Tube-Turn fittings of the same part number are identical in all dimensions. Quality-controlled Tube-Turn fittings incorporate uniform wall thickness, smooth inner wall and close-knit grain structure. This complete line is available in sizes ranging from one-half inch to 30 inches to meet all your fittings requirements.

Consult your favorite piping authority and see your Tube Turns distributor. For more information on the superiority of Tube Turns' exclusive manufacturing methods and data on successful installations in many industries, write for Catalog 111.

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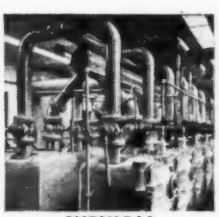
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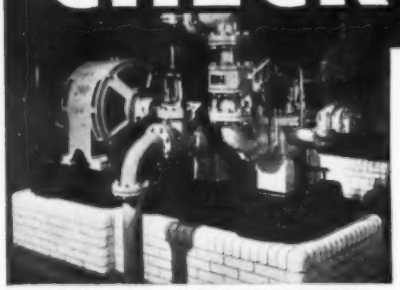

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hand primers are seldom used now. They are simply hand-operated displacement pumps, as at *P*, Fig. 4. A common form was the old-fashioned pitcher pump.

Q 12—*What are central-priming systems and central-automatic-priming systems?*

A—When there is more than one pump to be primed in a station, duplication of the priming device is avoided by having one serve all pumps. Such a priming setup is called a central-priming system. If the priming device and the venting of the pumps are automatically controlled, the system is called a central-automatic-priming system.

Q 13—*At what point on a centrifugal pump is air exhausted during priming?*

A—Usually air is exhausted from the high point of the volute. Generally a centrifugal pump, if started when the liquid covers its impeller's eye, washes out the remaining air entrapped in the casing. Some pumps are primed only from the suction waterways' high point. On others, notably large sizes, air is exhausted both from the volute's high point and that of the suction waterways.

Q 14—*What is a self-priming pump?*

A—The term is often used when the correct terminology would be *automatic priming*. Strictly speaking, self-priming is applied to pumps that (1) by inherent design or some self-contained hydraulic device, can function as wet-vacuum pumps (2) operate on the vortex principle or (3) operate on the same principle as compressors or vacuum pumps and are therefore self-priming.

Some centrifugal-pump designs have chambers and other devices so that water entrapped in the pump is recirculated, and by ejector action the unit removes air from the suction waterways. Such pumps are generally less efficient than those of conventional design, and have limited applications. Automatic-priming installations are now generally favored especially for stationary installations.

Q 15—*What is an automatically primed pump?*

A—Several automatically controlled priming systems have been developed for centrifugal pumps. A unit equipped with such a device is called an automatically primed pump. Most motor-driven pumps, when automatically primed, use a rotary wet-vacuum pump either direct connected, as at *P*, Fig. 5, or driven by a separate motor. With the direct-connected vacuum pump, when the centrifugal pump is primed, controls open the vacuum pump's suction line to atmosphere so it operates unloaded. The control stops a separately driven vacuum pump when the centrifugal is primed.

(*Continued on page* 144)

SEE FAIRBANKS-MORSE FIRST FOR DIESELS

One of the first Diesel engine manufacturers in this country, Fairbanks-Morse has pioneered a notable list of Diesel improvements. As a result, Fairbanks-Morse Diesels have earned an enviable reputation for outstanding performance.

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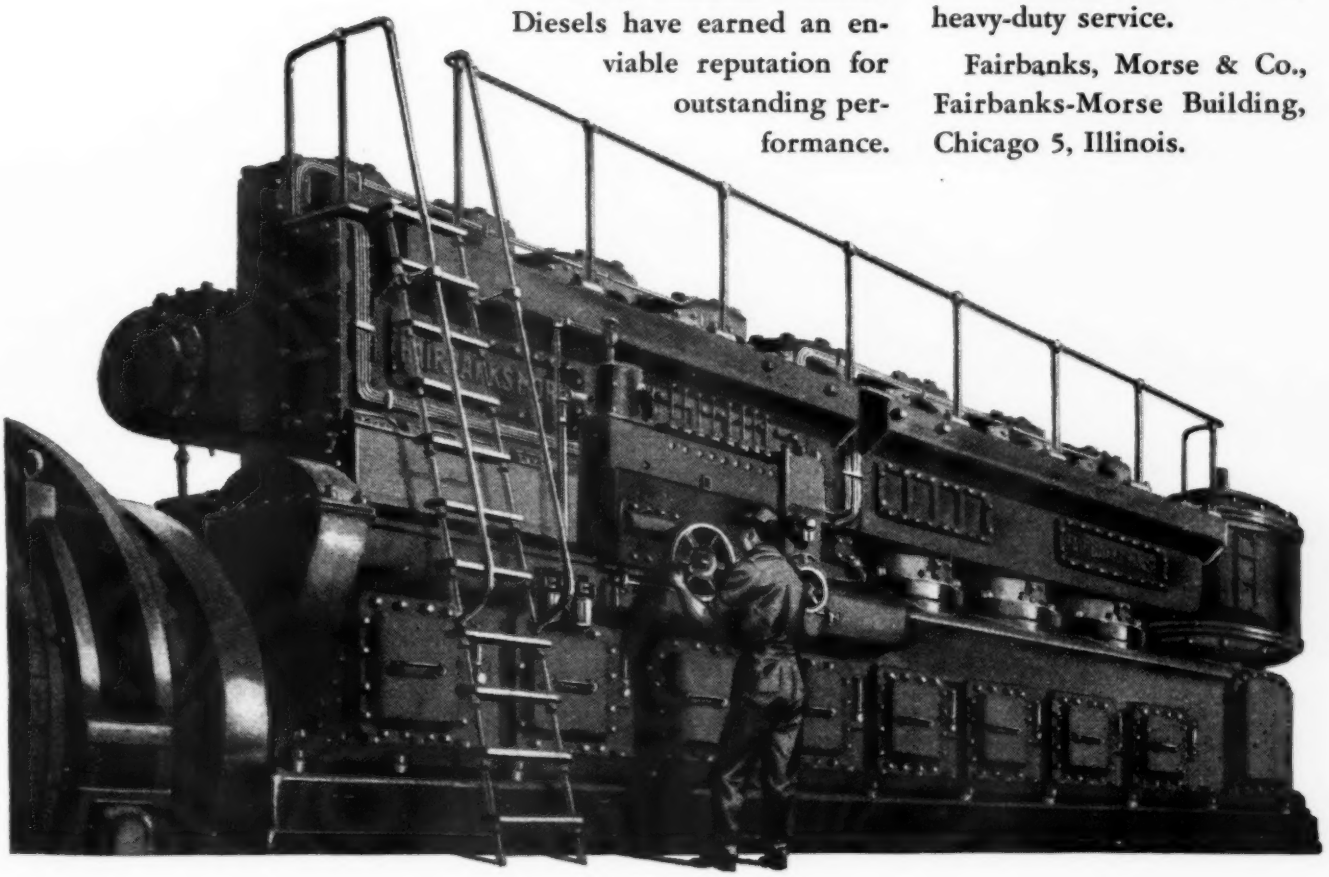

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● Put REX-TUBE type RT-15 on your tough, hard-to-handle connection problems. Then watch what happens when this rugged, high-quality flexible metal hose takes charge of the heavy-duty assignments! You can forget all about frequent replacements—costly delays. For RT-15 is famous for its ability to take punishment; to keep right on outperforming and outlasting many other types of hose under the roughest usage you can give it.

There are ample reasons why production men choose REX-TUBE type RT-15 when it comes to taking hard knocks. Illustrated below are just a few of RT-15's many outstanding features. Write us today and ask for Booklet E-144.

REX-TUBE (RT-15)—is strong and well-constructed to take years of wear and tear. Made from heavy strip, steel or bronze. Interlocked design, with inner packing of high-grade asbestos.

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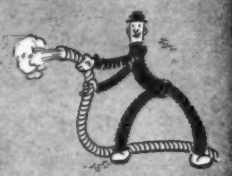

REX-TUBE—is part of the big, complete C.M.H. family of Flexible Metal Hose. RT-15 is only one type in the REX-TUBE line. There are other REX-TUBE types, in various sizes, with soldered or packed-on couplings, to meet practically any industrial requirement.

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Q 16—What determines the time required to prime a pump with a vacuum-producer?

A—The time is dependent upon (1) total volume to be exhausted (2) initial and final vacuum and (3) capacity of the vacuum producer over the range of vacuum that will prime the pump. Calculations to determine the time necessary for priming are involved. To permit a close estimate, jet primers are usually rated in net capacity for various lifts so it is simply necessary to divide the volume to be exhausted by the rating to get the approximate priming time. Unless such a simplified method is available for calculating the required priming time, selection of primer size would be best left to the equipment manufacturer.

Central automatic-priming systems are usually rated for the total volume to be kept primed. Time required initially to prime any one unit served by the system is not usually considered because the basic function of the system is to keep the pumps primed, ready to operate.

Q 17—Can a centrifugal pump operating with a suction lift be started from rest without priming?

A—Sometimes a pump that has been operating on a suction lift, when shut down, holds its prime for a considerable period if the suction line is tight and the stuffing boxes are in good condition and properly adjusted. Such units can be restarted as they are fully primed. The time in which a pump loses its prime depends on suction-line tightness and stuffing-box conditions. If a pump loses its prime quickly, check suction line for leaks and inspect the stuffing boxes.

Reader's Problems

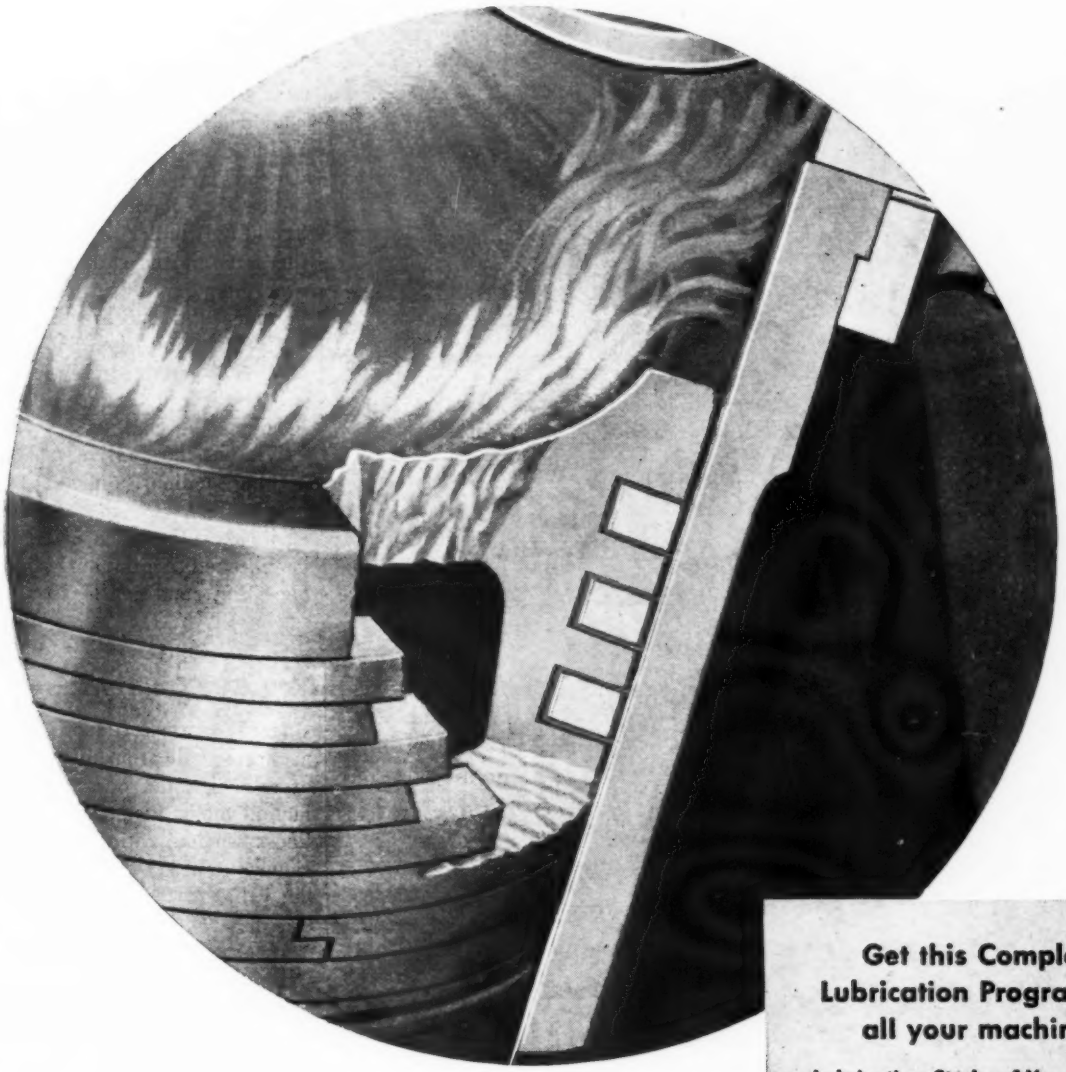
(*Continued from page* 111)

proximate and for specific boiler conditions.

Best economy is obtained when the unburned-fuel percentage is reduced to a minimum, and the flue-gas temperature kept as low as practicable. This indicates that maximum Btu is converted from fuel to steam with a minimum loss up the stack. Therefore for economical operation *LGS* should evaluate percent of unburned fuel and of excess air, and the flue-gas temperature.

I suggest he operate the stoker-fired boiler to carry the base load. He could then operate his hand-fired boiler intermittently when peak loads required its

Oil's "on the spot" in this ring zone!



HERE, in this ring zone, your Diesel oil is really "on the spot."

When combustion temperatures soar and hot gases push down and behind the rings, the oil you use must stand both the heat and the pressure. Carbon deposits that cause ring sticking, blow-by and loss of power must be held to a minimum.

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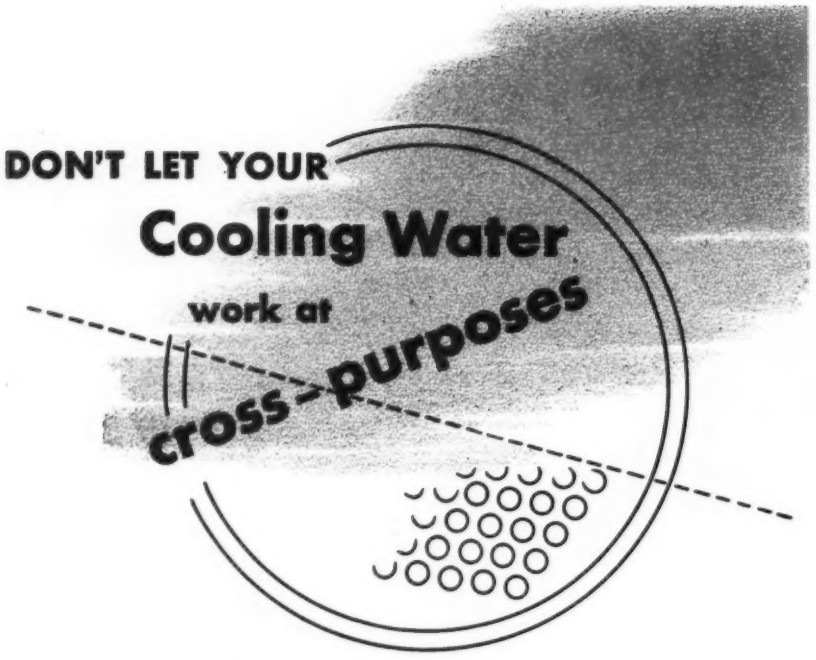

● Cooling water nearly always contains micro-organisms that threaten to defeat its cooling power. These organisms are the "slime-formers" that multiply at warm temperatures and form mucilaginous films on the water-side surfaces of condensers.

Particles of inorganic matter become imbedded in the slime, producing a tough, insulating coating that greatly retards heat transfer, often to such an extent that condensers cannot function at rated capacity

To clean out such deposits by any mechanical means requires expensive shutdowns *periodically*, for the slime immediately begins to accumulate again after every cleaning. Chlorination, however, destroys slime growths already present, and prevents recurrence by killing the slime-forming organisms in the water supply, so that water-side surfaces of condensers remain clean month in and month out.

Every cooling water system requires individual treatment to assure satisfactory slime control at minimum expense. W&T engineers will gladly make a survey and recommend the method of chlorine application best adapted to the particular needs of your plant.

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CD-215

additional output to the heating system.

An indicating flue-gas analyzer would be more effective and give greater economy than setting up a load-distribution chart. This analyzer has two indicating instruments: the first records unburned-fuel percent; the second, excess-air percent. One type of set has a pyrometer bulb connection, which has an indicating thermometer incorporated as part of the set. This thermometer could be connected to the existing pyrometer.

After this equipment is installed each boiler should be calibrated for economical operation. The stoker-fired boiler should be calibrated at ¼-, ½-, ¾- and full-load output. At each load point the dampers are adjusted until the analyzer indicates economical operation. The hand-fired boiler should be calibrated the same as the stoker-fired unit. However, damper adjustments should not be made until the fire burns quite vigorously and complete wood and coal combustion is obtained. Proper adjustment will be difficult because wood refuse supplements the coal.

Without the analyzer such adjustment is long, tedious, difficult and only approximate. With the analyzer the most efficient performance of each boiler can be checked continuously under various operating conditions.

Tenafly, N. J. K B HOFFMAN

Try CO_2 Analyzer

OUTLET TEMPERATURE ALONE is not an accurate indication of either efficiency or rate of boiler operation. Many other factors affect them, such as tube cleanliness, air-fuel ratio and combustion efficiency. These variations would lower the value of the chart desired by *LGS*. Gas flow as indicated by a differential draft gage across some part of the boiler setting would be of some assistance in equalizing loads between boilers. Using draft gage and pyrometer together would roughly indicate inefficient operation since stack loss is proportional to gas flow and temperature.

Without knowing the gas analysis or the relation of gas flow to steam produced a reliable calculation of stack loss is not possible. An orsat or CO_2 recorder gives an accurate picture of performance not easily obtained other ways. The biggest advantage for this type of operation is that it gives a single figure to maintain regardless of steam-production rate or fuel variations. If the cost of recording meters cannot be justified a semi-automatic CO_2 gas analyzer, together with a differential U-tube draft gage and the pyrometer, should give satisfactory results at moderate cost.

With the three instruments in use CO_2

Tells how, what, where and why

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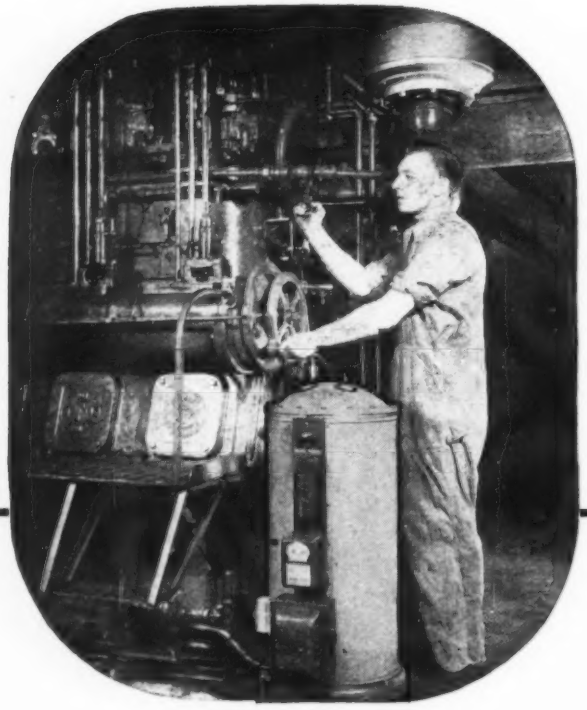

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● In many thousands of installations, Honan-Crane Purifiers are paying substantial dividends in reduced maintenance and operating costs of power generating equipment.

We quote below a typical report on the satisfactory performance of Honan-Crane equipment, received from Frank Keast, assistant plant superintendent, Armstrong Paint Co., 1330 Kilbourn Ave., Chicago, Ill.:

"One type of equipment that has more than paid its freight around here is the Honan-Crane oil purifier. We have four of them hooked up with our large Diesel engines. Before the purifiers were on the job we had to change oil every 500 hours. Now we keep on using the same oil. We find that the operation of Honan-Crane units not only keeps dirt and grit out of the engine bearings and simplifies maintenance, but saves us a good 25% on our lubrication costs."

● The Armstrong plant produces 5 million gallons of paint and varnish annually; operates a 250 kva GE turbine generator and a 500 hp Fairbanks-Morse 2 cycle Diesel generator at 250 volts in one engine room; three 400 hp Chicago-Pneumatic 4 cycle Diesel generators at 2300 volts in a second engine room.

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*City*_____ *Zone*___ *State*_____

would be held at a constant value and a maximum value set for outlet-gas temperature, which should not be exceeded. The draft gage would then serve as a rating gage to balance loads between the two boilers.

This method is simpler than attempting to follow a chart with incomplete control equipment or indications of important factors. The CO_2 value to be held will depend on the fuel and firing-equipment design. It should be determined by test. Differential draft gage can be calibrated in terms of maximum and normal loads so operators can readily duplicate efficient performance when settings for the various loads have been established.

Saint John, N. B. C G CLARK

Record the Steam Output

IN LGS's PROBLEM the chart he desires will not give a true record of load distribution, boiler load, efficiency, or show whether the individual boiler performance is good or bad.

Stack temperature is not an indication of boiler capacity since many variables affect this temperature. A clean boiler may be carrying a higher load than a dirty one, and yet show a lower or equal stack temperature. Soot, scale, poor firing methods easily affect stack temperature.

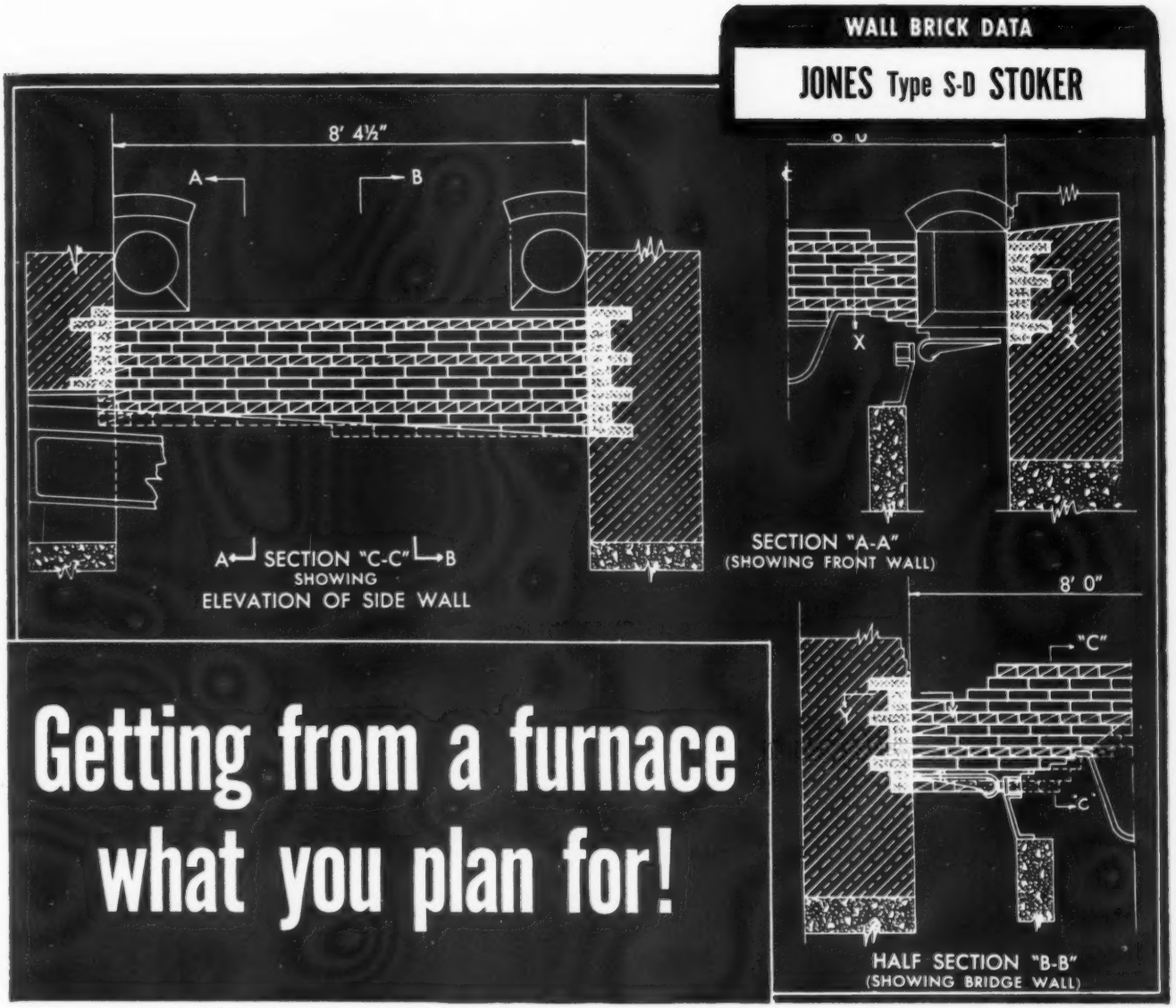
Each boiler could be fitted with an individual water meter, recording the amount of water evaporated. This would give a rough picture of load distribution, but to get a true record of load distribution, the stack temperatures and steam output should be recorded. In this way *LGS* would have a permanent record for each boiler. Any other method is inaccurate and misleading.

South Vineland, N. J. T DE ROSA

Test Boilers Separately

TO GIVE THE FIREMAN an idea of how to shift load between the boilers, *LGS* should first conduct a test of each boiler. He must obtain readings of the steam pressure, and the volume of steam discharged, and plot those against flue-gas temperature.

From these curves he can obtain the boiler pressure, and the flue-gas temperature when each boiler is running at rated capacity. The second boiler should be put in service when the first is running at about 133% of rated capacity. A simple line chart showing a temperature scale, pressure scale, or both, can be made with a region beyond a certain point clearly marked for dual operation of the boilers. It is advisable to divide



Getting from a furnace what you plan for!

Specifically designed for use with a Jones type S-D Stoker is the CARBOFRAX silicon carbide brick setting shown in the illustration.

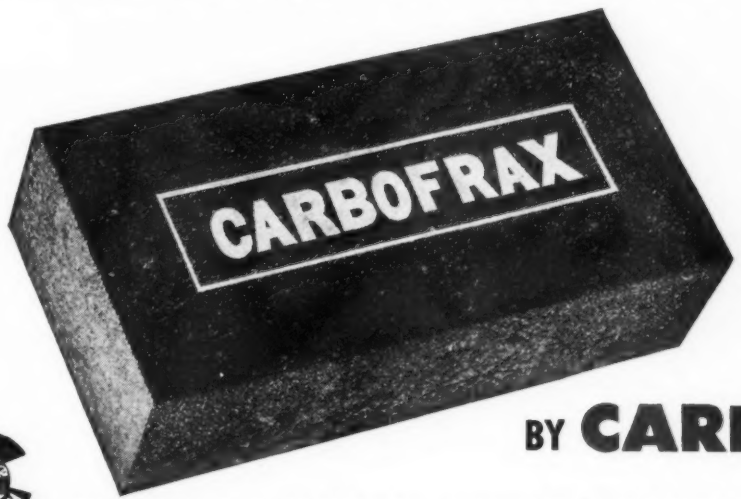
The height of the CARBOFRAX lining may vary depending upon the operating conditions encountered. But through its use greater furnace efficiency will result. Here's why:

1. Greater steaming capacity plus better fuel combustion is provided by full utility of the grate area. Space consuming, troublesome clinkers cannot anchor to the CARBOFRAX brick. Their hard, dense surface is retained at temperatures far in excess of those usually attained.

2. CARBOFRAX brick are extremely resistant to mechanical abrasion, spalling and cracking so that outages for lining repairs are few and far between.

3. With their remarkably long life, 8 to 10 years of steady service is not unusual —CARBOFRAX brick reduce labor and material expense. Since these brick do not burn or cut back, the upper walls are fully supported at all times. This too helps to cut costs.

Ask to discuss CARBOFRAX settings for your boiler furnaces. We will be glad to assist. Or, without obligation, write for a copy of "CARBOFRAX in Boiler Furnaces", to Dept. G-46, The Carborundum Company, Refractories Division, Perth Amboy, New Jersey.



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the load equally between the two units if they have the same capacity.

ANTONIO DI LORENZO
West New York, N. J.

Answers to Feb Question 2

(*Continued from page* 113)

under the belt. The holes should cover the cross-section of the board by running diagonally across in each foot of the conveyor length. Across the bottom, he should mount a removable sheet-iron bottom, which will slide the salt back to the hopper end as in sketch 2-N. The vibration of the conveyor should make the salt slide down the sheet-iron bottom.

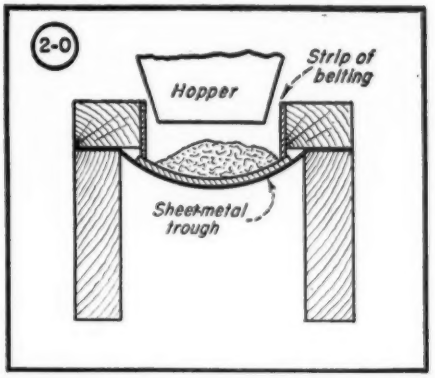
If the conveyor slope is so small that salt will not slide down the chute, the sheet-iron bottom should be sloped so the salt slides out the side of the conveyor and collects in a side trough.

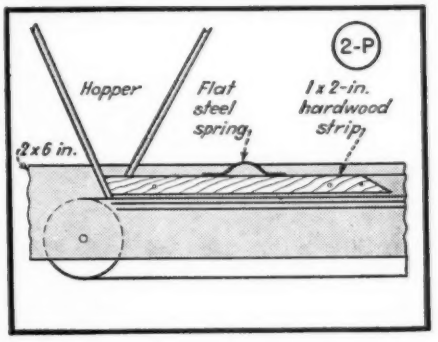
Boise, Idaho FRED MCCORMICK

Drive From Discharge End

IN MY OPINION this unorthodox salt conveyor can be made to work by (1) changing drive so as to drive from the discharge end of conveyor instead of from the loading end (2) making a trough for belt to slide in, to hold the salt better as in sketch 2-O (3) adding a skirt, also shown in sketch.

Wayne, Pa. PAUL HOLLOWAY

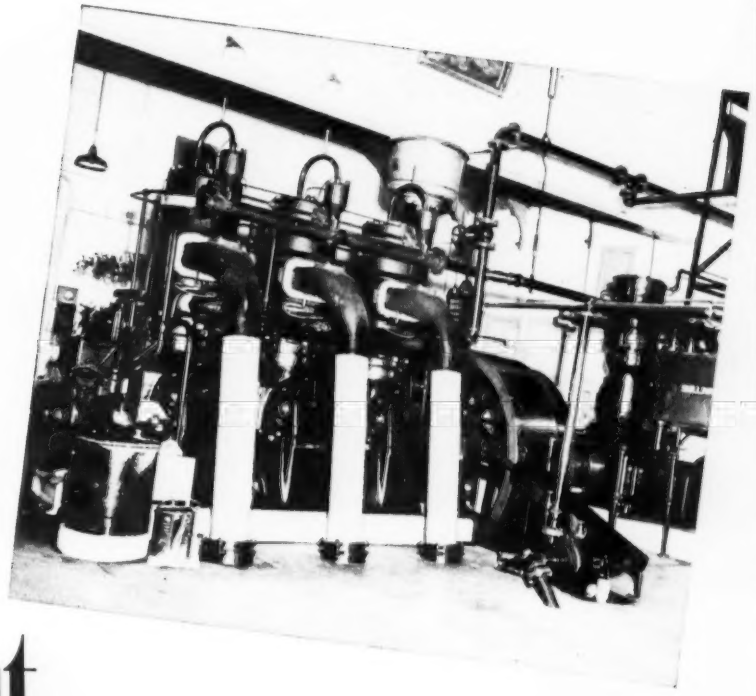




Mount Strip Over Belt

I BELIEVE two hardwood strips, sketch 2-P, bolted to the inside of the 2x6-in. side boards and held snug against top of the canvas belt by spring steel clips

Saves two overhauls and 20% of lubricant cost



NONPAREIL HD
DIESEL OIL

Since changing to Nonpareil HD Diesel Oil, a Midwestern city water department has had 15 months of uninterrupted service from its 150 H. P. Diesel. This engine operates under difficult conditions. Before Nonpareil HD was installed, it had been necessary to shut down every six months to free stuck rings and to clean carbon.

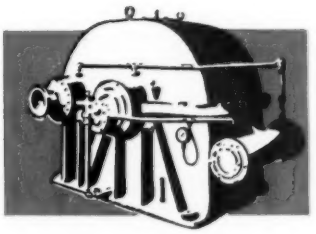
Thus, during 15 months of service, Nonpareil HD eliminated two tough jobs of overtime maintenance work. In addition, it saved 20% in oil costs.

Nonpareil HD Diesel Oil is one of two types supplied by Standard for industrial Diesels. It is an oxidation inhibited and detergent oil for heavy duty service. Standard also supplies Nonpareil Diesel Oil, a highly refined, clean operating, straight mineral oil. A Standard Oil Lubrication Engineer can give you an unbiased recommendation on the oil you need to get low cost, reliable service from your Diesels. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you.

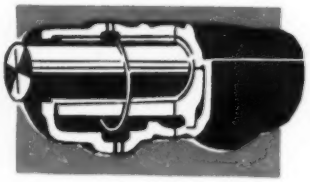
STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

Improved STANOILS

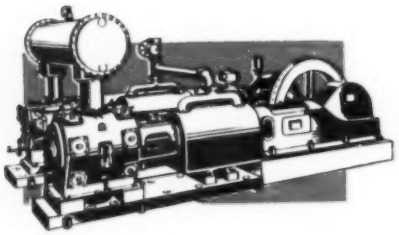
...last longer in gear cases



...in bearings



...in compressors



...and hydraulic systems

STANOILS have long been outstanding for relative freedom from deposit formation, and for their long lasting quality in all types of service. Now by the addition of an oxidation inhibitor, developed by Standard Oil, the oxidation stability of Stanoils has been improved many-fold.

With improved Stanoils, oil acidity will remain at a safe low figure for long periods of operation. At the same time, deposit formation is practically eliminated. In addition, an effective defoaming agent is used.

These advantages can be secured for a variety of applications, because improved Stanoils are available in a wide range of viscosity grades. In fact, you may find that Stanoils can be applied to all your lubricating jobs, with consequent simplification of ordering and stocking.

A Standard Oil Lubrication Engineer will be glad to help you test improved Stanoil and point out equipment in your plant in which the high stability and clean operation of Stanoil can save maintenance time and money. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you.

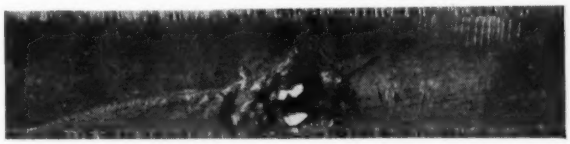
STANDARD OIL COMPANY (INDIANA)

STANDARD SERVICE

HOW THE ANODIC POINTS WERE CAPTURED

In many cases where a condenser tube has proven unsatisfactory in a given application, analysis of conditions will show the cause of the failure to be outside the tube itself.

A Scovill engineer was requested to explain the puzzle of the consistent failure of tubes in the first pass of a marine condenser. 18 tubes had failed in this pass, as the result of intense local pitting.

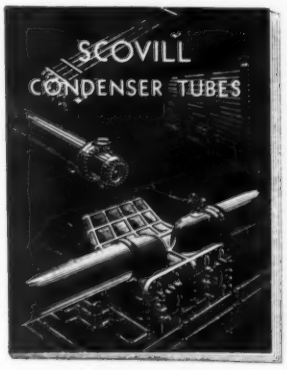


Deposits Had Done It — He found that the pitting was due to "deposit attack", an electrochemical type of corrosion initiated by foreign material lodged against the tube walls. Where such deposits covered the metal, those "islands" became anodic to the adjacent uncovered areas, with resultant intense corrosion of the anodic area. In this case, turbulence of the water passing around the deposit caused erosion-corrosion on downstream side of deposit.

Examination showed no evidence of any other type of corrosion.

The suggestion of the Scovill engineer which aided in the solution of the problem was to modify the circulating water inlet and to establish a regular practice of cleaning the tubes, using rubber plugs, bristle brushes or other equipment that would not score the tube walls.

Three Scovill Services — Scovill *Service in Men* provides specialized study and advice on individual tube application problems and on installation practices. *Service in Metals* includes production of many tube alloys, and also offers you the facilities of our laboratory to help determine the alloy best suited to your conditions. *Service in Manuals* provides valuable literature on condenser and heat exchanger tubes; for a free copy of our Condenser Tube Booklet, address Scovill Manufacturing Company, 13 Mill St., Waterbury 91, Conn.



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Service in Metals
Service in Men

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Scovill
CONDENSER TUBES

RODA

High grade gas, by-product and steam coal from Wise County, Va., on the Interstate Railroad.

DENDRON

High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA

High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

PREMIX STOKER

A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

COKE

Roda and Stonega from Wise County, Va., and Connellsville Coke from Pennsylvania.

CRITERION COAL

High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

CROZER

Genuine Third Vein Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railroad.

Admiralty Coal

Genuine New River Smokeless, Beckley or Sewell seam from Raleigh County, W. Va., C. & O. and Virginian Railroads.

Old Kentucky

Hazard No. 4 and No. 7 steam and domestic coal from Wiscoal, Knott County, Kentucky, on the L. & N. Railroad.

CHARMCO

Unexcelled Steaming Coal from the Fire Creek Seam in Greenbrier County, W.Va., originating on the N.F.&G.R.R.

ANTHRACITE — Hazle Brook Premium . . . Raven Run

General Coal Company

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would prevent salt getting under *BDL*'s belt. It would be drawn down against the support board by the hardwood strips. If the belt were driven from the discharge end, operation would be smoothed out. This would cause the belt to hug the support board and decrease the salt space.

Mt Dennis, Ont. C R DAY

Concave Shape for Belt

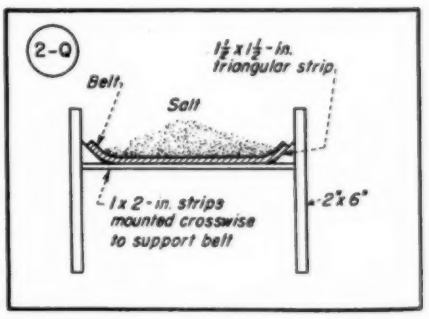
THERE ISN'T MUCH DOUBT that *BDL* could overcome 90% of his trouble if he would drive his conveyor from the other end; that is, instead of pushing the material up with the belt, he should pull it up. In this way the belt tension would be on top at all times, and the slack on the bottom.

By driving the conveyor the way he is now doing, he pulls the belt from under, and creates slack at the top. Furthermore, when the weight of the salt hits the belt, tension under the conveyor increases, and slack also increases at the top. Salt then has ample opportunity to accumulate under the loose belt, that is, between the loose belt and the supporting board.

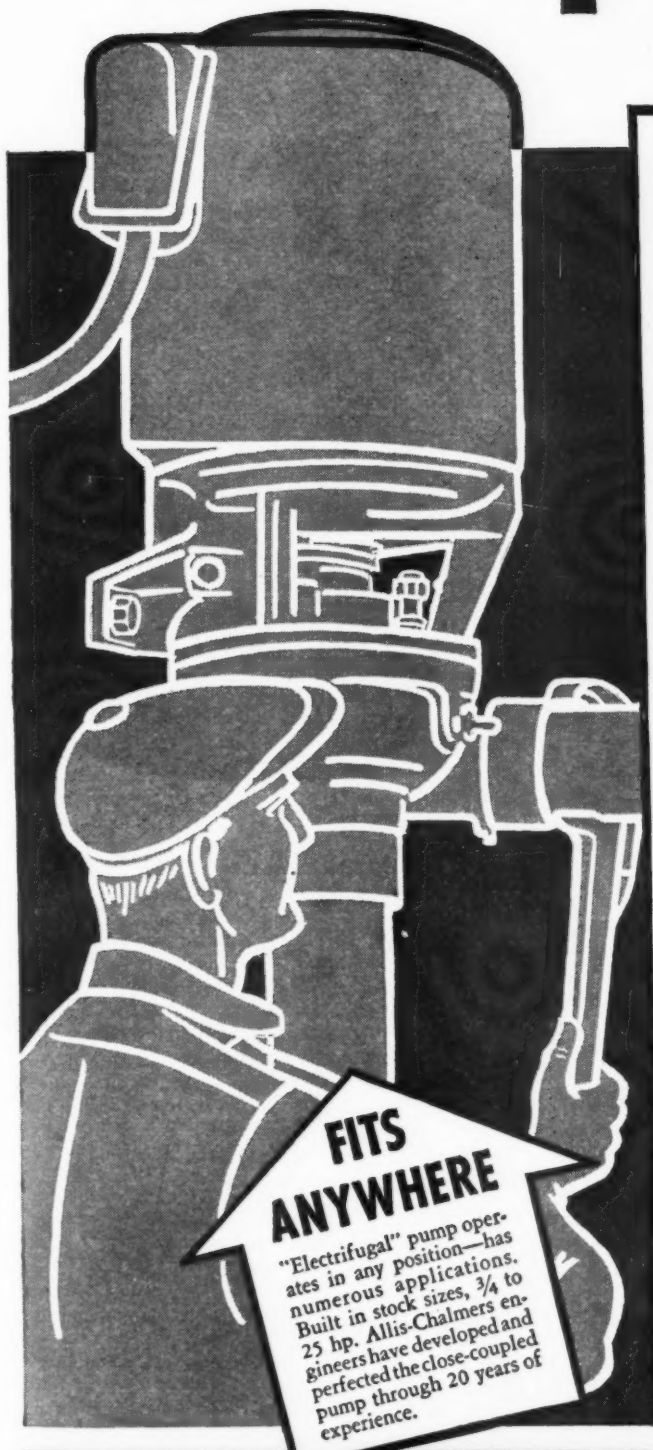
If *BDL* keeps his belt pulled tight from the upper end, there should be little or no chance for salt to accumulate under it. It would also be a good idea to install a triangular piece of 1½x1½-in. lumber, which would hold the belt in a concave shape. This would help to keep the salt towards the center of the belt. To remove the salt accumulated under it, he could replace the 1x6-in. belt support, and use 1x2-in. strips of wood laid crosswise, which would provide spaces for the salt to fall through. He should also have a deflector of some kind installed near the lower pulley to scrape off the salt that falls through. Sketch 2-Q shows a cross-section of the triangular pieces of 1½x1½-in. lumber. I do not believe that *BDL* needs to replace his present belt support. He should, however, drive the conveyor from the opposite end, and install the triangular strips of wood in order to hold the belt in a concave shape.

A J BEAUDRY

Medicine Hat, Alberta

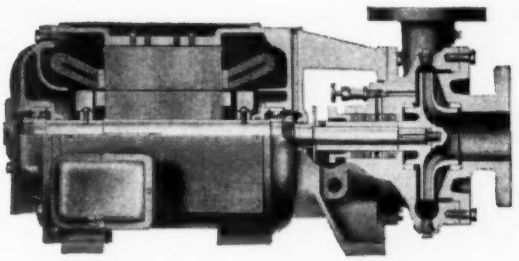


Hook Up...AND Pump!



FITS ANYWHERE

"Electrifugal" pump operates in any position—has numerous applications. Built in stock sizes, ¾ to 25 hp. Allis-Chalmers engineers have developed and perfected the close-coupled pump through 20 years of experience.



A-C "Electrifugal" Pump Cuts Installation Time

This compact "Package" pump comes fully assembled. No coupling to line up. Just bolt it down, make pipe and power connections — prime and pump! More than that, this pump costs you *less to buy — less to operate.* Read these interesting facts:

SIMPLE, COMPACT DESIGN

Motor and pump are built into one rigid frame, with rotor and pump runner on a single shaft. Result: one third less space — fewer parts — *lower cost.*

EASY TO SERVICE

Packings, rotor, impeller, and all moving parts are easy to get at. Quickly taken apart, checked, and reassembled. Down time is reduced to a minimum.

LOW MAINTENANCE

Ample bronze wearing rings, bronze water seal and valve — shaft sleeve and deflector — five packing rings — precision workmanship — and other quality features all add up to longer life, less maintenance cost.

UNDIVIDED RESPONSIBILITY

Allis-Chalmers builds both pumps and motors — backs them up with unsurpassed experience and reputation in both fields. Call your A-C office for help on any pumping problem . . . or write for bulletin B6059. ALLIS-CHALMERS, Milwaukee 1, Wisconsin.

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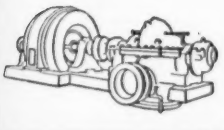
Electrifugal **PUMPS**



COMPLETE LINE

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VOLTAGE REGULATOR

The Burlington Synchrostat, Type SR, Model SF, has proven to be the answer to the problem of voltage regulation in numerous installations. Its inherent sensitivity in following voltage changes makes it respond quickly and accurately in restoring generator voltage to normal.

SPECIAL FEATURES ARE:

Simplified control . . . rugged construction . . . simple installation . . . minimum maintenance . . . unaffected by reasonable vibration . . . automatic polarity reversal . . . rapid, positive response to maintain normal voltage.

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B

Engineer's Bookshelf

(*Continued from page* 124)

bearings are discussed in chapter one, together with data on dimensional proportions, running accuracy and tolerances of each design.

The second chapter deals with theory of such subjects as nature of rolling resistance, friction torques, friction coefficients, stresses and deformations, load distribution, motion and inertia. Other chapters consider studies in carrying capacity of ball and roller bearings, bearing selection, design of bearing applications, mounting and dismounting, lubrication, maintenance, and bearing failures. The final chapter includes tables, conversion values, and a description of symbols and abbreviations. Every one interested in bearing applications will find this book helpful.

ALEMITE ANSWERS (1945) 223 *pp*, 5½x8½, *illust, cloth*, $3. *Alemite Division, Stewart-Warner Corp, Chicago* 14, *Ill.*

Here is a book on lubrication that anyone can understand. Style and presentation and much of its content owe their origin to experience in preparing lubrication material for the armed forces during the war. It is a graphic study with hydrocarbons cavorting in animated movie style, and cutaway views of bearings and other friction points to demonstrate in layman's pictures and terms the how, what, where and why of lubrication.

The book is divided into seven chapters: explaining petroleum and its chemistry, refining and testing of petroleum fuels, refining and testing of lubricants, fundamentals of lubricants and lubrication requirements, answers to practical lubrication problems, pressure lubrication, and purchasing and the function of selling. Those interested in knowing more about lubricants and lubrication will find this book engaging and instructive despite a commercial flavor in places.

INDUSTRIAL ELECTRIC WIRING (1945) *E A Lincoln, consulting engineer.* 336 *pp*, 5½x7½, 192 *illust and tables, cloth*, $3. *Essential Books*, 270 *Madison Ave, New York* 16.

From the opening chapter on the wide use of electricity throughout industry to the final reference index the author follows a plan of presenting his material for the ready assimilation of operating or design engineer.

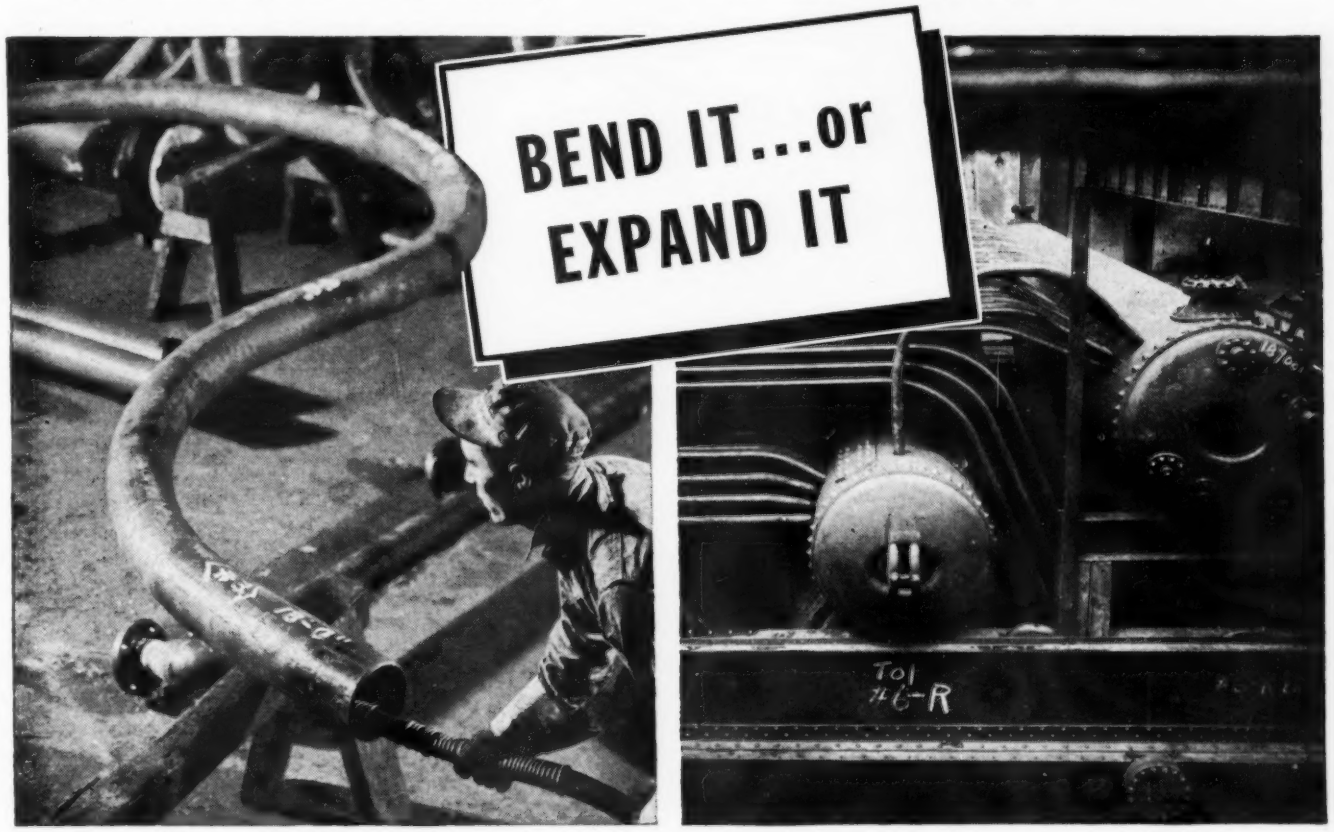
A chapter on electrical fundamentals should interest student and apprentice for here appear text and diagrams of various wiring arrangements possible in ac and dc work.

The author then proceeds through the steps of designing and installing all the wiring systems recognized by the National Electrical Code. A separate chapter covers polarity identification. Similar treatment is given protective grounding.

A complete listing of all wiring devices including fittings forms a valuable part of this book. In addition to listings and text a liberal portion of various NEC code requirements appear with those items they cover so the book keeps its practical viewpoint throughout.

HIGH DUCTILITY — NATIONAL Seamless is easy to work. Can be bent into intricate shapes without danger of splitting.

TIGHT JOINTS result from the better forming qualities of NATIONAL Seamless Boiler Tubes.



. . . Seamless is Safest!

THE safe and efficient operation of a power plant depends largely on the qualities of the steel pipe and tubes used in its construction. The seamless process — piercing a solid billet of steel to form the basic tube— is in itself your best assurance of a good sound installation because of uniform wall strength in every tube.

Only the highest quality steel, free from irregularities, can be used for making seamless pipe or tubes because the piercing action would disclose the minutest defects in the billet. Therefore, seamless pipe or tubes are uniform throughout their length, both because of good steel and the absence of a longitudinal weld or line of potential weakness. NATIONAL Seamless Pipe and Tubes are made under the careful supervision of experienced metallurgists, who, by suitable annealing operations where necessary, see that each tube has the best combination of ductility and strength throughout its length for the service intended.

These factors result in a pipe or tube which offers maximum safety and continuous reliable service. When such a large proportion of the pressure parts of a plant consist of pipe and tubes, are you justified in using any but top quality—Seamless? And remember, NATIONAL Seamless means "America's Preferred Pipe and Tubes".

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Every SUNDAY EVENING
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UNITED STATES STEEL

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No matter where you do business, even in the smallest town, the speed of Air Express is at your service — between thousands of U. S. communities and scores of foreign countries.

Yes, when "getting something fast" means better serving a customer or clinching a deal, keeping a factory open and men at work — Air Express more than pays its way. It's a money-maker.

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1049	1.17	1.98	7.68	12.28	30.70¢
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Over 2350	1.47	3.68	18.43	29.47	73.68¢
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In the face of rising prices, Air Express rates have been slashed 22% since 1943, saving business millions of dollars. And rates include special pick-up and delivery in all principal U. S. towns and cities — with fast, co-ordinated air-rail service between 23,000 off-airline points. Service direct by air to and from scores of foreign countries in the world's best planes, giving the world's best service — at lowered cost.

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CONDUCTORS AND WIRING LAYOUTS (1945) *By E S Lincoln, consulting engineer.* 342 *pp*, 5½x7½, *many tables and illust, cloth*, $3. *Essential Books*, 270 *Madison Ave, New York*

A comprehensive, information-packed reference book compiled for detailed coverage of wiring, wiring operations and materials. This work opens with a brief treatment of conductors as such in which are considered copper characteristics, the circular mil, conductor heating, skin and induction effects.

After establishing his subject the author follows with a fund of insulation methods, their applications, limitations and features of construction. He next progresses to a discussion of rewiring existing systems, mentioning newer insulations and their practicality for such a job.

Other major divisions covered in the book are conductor and cable splicing and connections, various insulating tapes, services, feeders, code requirements for branch circuit, appliance, emergency lighting, motor, switchboard, welding and sundry wiring needs.

Closing chapters consist of one on the AIEE standard graphical symbols and another on the important personal safeguard, artificial respiration.

PRIMARY AND STORAGE BATTERIES (1945) *E S Lincoln, consulting engineer.* 168 *pp*, 5½x7½, 69 *illust, cloth*, $3. *Essential Books*, 270 *Madison Ave, New York* 16, *N. Y.*

Employing the same practical formula that features the author's other books, this text on the two general classes of batteries should prove most valuable. Application, advantages, different factors affecting voltage, some of the more generally considered battery characteristics form the background for an introduction to primary batteries.

Details of selection and operating life as well as other pertinent information are discussed for dry cells, wet cells, copper oxide and caustic soda types of primary batteries.

A discussion of fundamentals, applications, charging and discharging and various other information comprise subjects covered in chapters on lead acid and nickel iron alkaline storage batteries.

Additional items covered are wiring, emergency lighting, definitions, generators, battery accessories and rectifiers. To complete a comprehensive work important battery and rectifier maintenance come in for separate treatment.

INDUSTRIAL ALGEBRA AND TRIGONOMETRY WITH GEOMETRICAL APPLICATIONS *(first edition,* 1945) *By John H. Wolfe, former director Ford apprentice training, William F. Mueller, director of training, and Seibert D. Mullikin, assistant director of training, all of Ford Motor Co.* 389*pp*, 5½x8½, 188 *figures, tables, cloth*, $2.20. *McGraw-Hill Book Co.*, 330 *W. 42nd St., New York* 18, *N. Y.*

This book, for students who have had a course in elementary algebra, is aimed at showing clearly the application of mathematical principles to the practical problems of modern industry. These engineering problems are generally of a geometrical nature involving use of plane and solid geometry together with numerical shop

EXIDES HAVE THE EXTRA POWER DIESEL CRANKING DEMANDS

These powerful, ruggedly built Exides are designed specifically for this toughest of cranking jobs. They are a development of years of close identification with Diesel engineering progress, with which they have kept pace. For dependability, long-life and ease of maintenance, give your Diesel cranking job to Exides.

Write today for a FREE copy of the Exide Catalog on Heavy-Duty Batteries. It gives you catalog data and information on how to get the most from your Diesel Cranking Batteries.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

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BATTERIES
FOR CRANKING
DIESEL ENGINES

For the first time in over four years we are now able to quote immediate delivery on U. S.-made hand-cranked "Megger" Insulation Testers.

Not until war came did anyone realize the tremendous number of insulation testers that were going to be needed, nor what a vital place "Megger" instruments were to have in the picture. Now that our Philadelphia factory has been in full production for nearly three years, these heavy demands have been met, and we can again invite orders from both old and new customers alike. We take pride in being able to offer the same rugged and dependable "Megger" instruments in various ranges up to 2000 megohms and with hand-cranked d-c generators up to 1000 volts. We continue to supply other types and ratings of "Megger" instruments as formerly.

If you are uncertain which type and range of insulation tester is best for your particular needs, write us, telling the type, size and rating of your equipment. We will gladly make recommendations. Also ask for illustrated Bulletin 1735-P.

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Insulation Testers, Ground Testers, and Ohmmeters

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trigonometry and analytic trigonometry.

Virtually all the geometrical problems were selected from thousands of examples that occurred in the engineering department of the Ford Motor Co. These are classified with enough duplication to afford the student sufficient practice to aid memorization. Old principles have been applied to new, practical problems. The suggested methods of analytic geometry for problem solution save much time and work. The book includes only special cases of compound-angle problems making no effort to cover the complete field of this particular subject of trigonometry.

The book can be used as a text or as supplementary study material and it will also serve as a handbook.

At the 52nd annual meeting of American Society of Heating and Ventilating Engineers, held recently in New York City at the Hotel Commodore, the members approved an amended charter, voted to change the nominating committee procedure and adopted a revision in the method of handling funds, at the first business session.

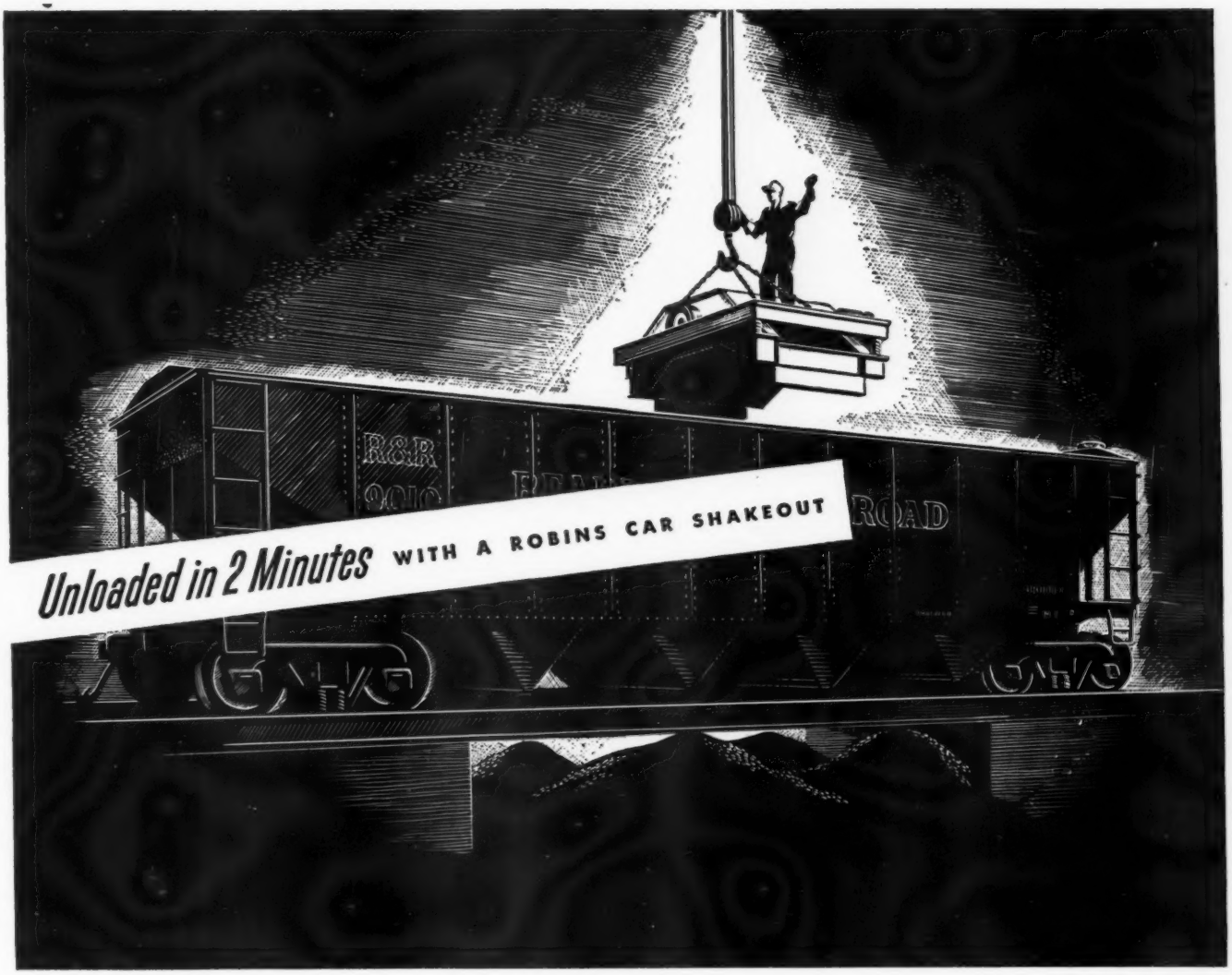
Newly elected officers are as follows: (1) *President:* Alfred J Offner, consulting engineer, New York, N. Y. (2) *First vice-president:* B M Woods, director, University Extension, University of California, Berkeley, Calif. (3) *Second vice-president:* G L Tuve, professor of heat-power engrg, Case School of Applied Science, Cleveland, O. (4) *Treasurer:* John F Collins, Jr, Pittsburgh, Pa., also secretary-treasurer of National District Heating Association.

During the annual banquet, at which W H Driscoll served as toastmaster, the presentation of the F Paul Anderson Medal was made by Dr W H Carrier, Syracuse, N. Y., to Capt A E Stacey Jr for his contributions to the heating, ventilating and air-conditioning field.

American Society of Mechanical Engineers, through its committee on international relations, announces a nationwide campaign for restoration of engineering libraries in war-devastated areas and appeals to engineers to assist with gifts of technical books and periodicals to replace those lost or destroyed. Supporting the movement besides ASME are four other engineering societies.

Send a list of books you wish to donate to the campaign to George A Stetson, Editor, American Society of Mechanical Engineers, 29 W 39th St, New York 18, N. Y. State title, author, publisher and publication date. Do not ship until instructions are received from the committee because distribution points will vary with location of donor and libraries to be restocked. Donations of money will be used to buy new books for foreign technical libraries. Draw checks to the order of "American Society of Mechanical Engineers" and mark for "International Book Fund."

Pyrene Mfg Co discards eleven trade names in favor of only one trade name and more informative labeling. The type of unit has been added with the Pyrene name. Now, for example, a *Fastfome* extinguisher becomes a Pyrene *Foam.*



Only 2 minutes were required to empty a packed coal car using the exclusive *New* Robins Car Shakeout.

This is just one example of how this amazing "Job-Engineered" 1st, pioneered and developed by Robins, can help you save time, money, and equipment.

Operating at high speed, this machine literally shakes a load of tightly packed coal, coke, or ore through the hopper doors at the bottom of a railroad car—just as though a pair of giant hands picked up the car and shook it. Records of less than two minutes per car are by no means uncommon, and two men can do the work that previously required six or more.

No elaborate installation equipment or housing is required. Actually, you can use a Robins Car Shakeout anywhere a 5-ton hoist can be installed. In addition, this new Robins product does not injure cars or unloading facilities in any way.

A note or phone call will bring complete literature or a "Job-Engineer" to your desk to give you all the facts on how this exclusive *New* Robins Car Shakeout can help solve your hopper-car unloading problems.

AMERICA'S ONLY *COMPLETE* MATERIALS HANDLING SERVICE

Hewitt and Robins unite to offer you 136 years of combined experience in "Job-Engineered" rubber products and machinery designed to answer any materials handling problem you may have.

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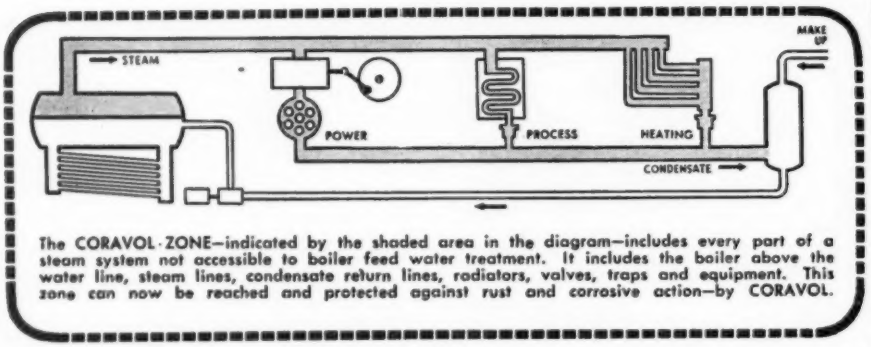
Here's How to PREVENT CORROSION *in Your Steam System . . .*



The CORAVOL ZONE—indicated by the shaded area in the diagram—includes every part of a steam system not accessible to boiler feed water treatment. It includes the boiler above the water line, steam lines, condensate return lines, radiators, valves, traps and equipment. This zone can now be reached and protected against rust and corrosive action—by CORAVOL.

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SAVES YOU COSTLY PIPE REPAIRS, REPLACEMENTS, MAINTENANCE LABOR, HOURS AND DAYS OF SHUTDOWN LOSS

CORAVOL in your steam system (1) prevents corrosion in steam and condensate lines, (2) cleans out clogging rust deposits resulting from previous corrosion.

NOT A BOILER FEED WATER TREATMENT

When fed to your steam system, **CORAVOL** *volatilizes* with the steam, *condenses* with the steam, and dissolves in the condensate. It does not remain in any one zone, but circulates throughout the entire system and protects *all* zones from corrosive attack.

CORAVOL SAVES FUEL. In cleaning out and protecting lines **CORAVOL** increases and maintains the effectiveness of heat transfer surfaces; restores and maintains original capacity of lines and the operating efficiency of valves and traps. For 9 years, **CORAVOL** has proved its value in hundreds of steam heating, process and power plants in more than 20 different industries. WRITE TODAY for complete FREE data about the **CORAVOL** process.

The use of CORAVOL in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

CORAVOL is part of a complete technical service which provides special formulas of treatment for:

Boiler Feed Water . . . Hot Water Supply . . . Refrigerating Brine . . . Cooling and Condenser Water . . . Rapid Scale Removal . . . Coagulation . . . Algae Control.

WESTERN CHEMICAL COMPANY

715 WASHINGTON KANSAS CITY 6, MISSOURI

56 Years of Know-How in the Chemical Treatment of Water

Power News

(*Continued from page* 130)

A further attraction, an inclosed observation platform, has been included in design of the high tower on which the turbine will be constructed.

S Morgan Smith Co had assumed major share of financial sponsorship prerequisite to erection and operation of the experimental unit on Grandpa's Knob. However, at the end of 1945, following comprehensive cost studies, it became apparent that economic production of wind-generated power was not immediately feasible on a competitive basis and that continuing experimentation and study would be required to reduce unit cost of such power.

Jackson & Moreland, Inc., estimated that Central Vermont Public Service Corp could afford to pay about $130 per kw for a block of 10,000 kw, operating under wind conditions of a 4000-ft Vermont ridge. S Morgan Smith Co estimated that such a block of capacity, based on original test-unit design, could be installed and tied into existing high line of the utility, without profit, at an approximate cost of $190 per kw. Redesign, based on experience to date, might bring this figure down to $130. However, experimentation necessary to determine whether such a reduction in cost could be achieved would require an investment of several hundred thousand dollars, without definite assurance of a successful outcome. The company therefore abandoned the project and dedicated wind-turbine patents to public domain.

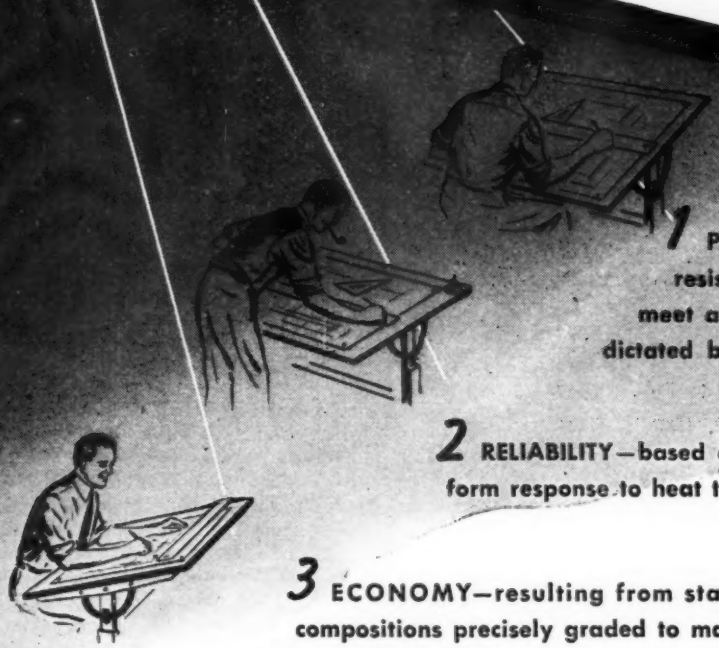
It is the intention of Windpower, Inc, to carry the project through to what it is hoped will be a successful conclusion, without financial support of S Morgan Smith Co or of Central Vermont Public Service Corp, a collaborator in the original experimental project.

To provide for the record a full report of their research and experience in the aero-electric power field, S Morgan Smith Co has retained Mr Putnam to prepare an illustrated volume of about 75.000 words, summarizing lessons learned and assessing probable future worth of large-scale wind power.

The original installation made history when, on Oct 19, 1941, it utilized wind force for the first time to deliver synchronous ac to a utility system. During an unusually windless three weeks preceding a blade failure which, on Mar 26, 1945, forced a shutdown of the project, the test unit, in 143 hours on the line, generated 81,780 kwhr, thus exceeding estimated efficiency.

Triple reasons for specifying...

TRIPLE ALLOY STEELS *containing* NICKEL



1 PERFORMANCE—Strength and toughness, resistance to wear, fatigue or shock to meet a wide range of requirements, as dictated by design.

2 RELIABILITY—based on consistently uniform response to heat treatment.

3 ECONOMY—resulting from standard compositions precisely graded to match the engineers' needs.

Experience shows that triple-alloy steels containing Nickel are solving some mighty big problems in many industrial fields. They have established outstanding service records in some of the most exacting applications. The many standard compositions available make it possible to select *accurately,* and with economy, triple-alloy steels to fulfill the requirements of a great variety of applications.

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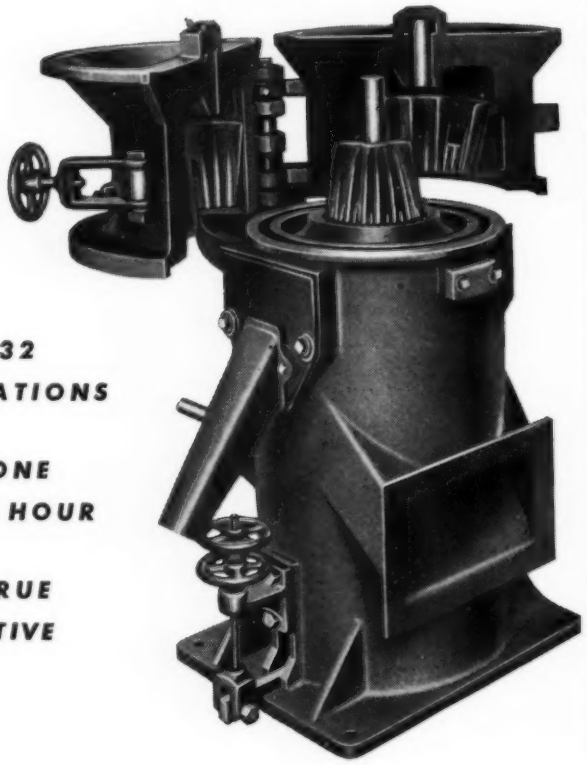

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The Sturtevant automatic coal sampler enables you to make accurate coal-samples quickly and easily. All you do is feed the coal or coke into the hopper . . . the sampler does the rest, discharging a homogeneously representative mixture through the sample spout ready for analysis.

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Issue Annual Reports on Hydro Generation

Bonneville Power Administration's practice of selling power capacity rather than energy stood the agency in good stead during the fiscal year ended last June 30, for revenues increased almost 10% during the year despite a small decline in kwhr sold. Sales totaled 8,502,000,000 kwhr during the fiscal year, a decrease of 169,000,000 kwhr from the total of fiscal 1944, but revenues rose from $20,896,000 to $22,990,000. BPA indicated that a maximum of 600,000 kw, or about 50% of total capacity, may become available for remarketing as a result of cancellation of war loads. Its annual report showed an intensive campaign aimed at selling the cancelled capacity to be under way.

Among the marketing possibilities under study is railroad electrification. BPA research indicated that numerous specified products can be produced in the Northwest. They have been discussed with industrial representatives and it is expected that a number of new Northwest plants will be constructed in the near future as a result of these contacts.

Contracts were entered into with five educational institutions for research and investigation of several uses of electric energy. The institutions include Oregon, Washington and Montana State Colleges, University of Washington, and Linfield College. Some of the subjects investigated include electric radiant-panel and reversed-cycle heating, electric heat storage, possible improvements or changes in a design of distribution systems resulting in a lower cost of distribution and economics of the heat-pump method for domestic heating.

Annual report of Southwestern Power Administration showed sales of 453,180,939 kwhr during the fiscal year. During the last 3½ months of 1945 the administration had energy from Norfolk and Denison dams to add to generation at Pensacola dam. Revenues from Norfolk energy sales, which started March 6, 1945, were $321,593 through last June 30. Revenues from Denison, whose commercial generation began March 9, 1945, were $313,892.

During the year, SPA worked on a broad report outlining the system it will require to market energy generated at more than 30 Army Engineer dams authorized for the region. Its annual report noted that it will be necessary to obtain a return of about five mills per kwhr from energy sold at wholesale.

The Reclamation Bureau, its annual report showed, generated almost 14,000,000,000 kwhr during the fiscal year, revenues from which totaled more than $20,000,000. Existing power plants of the bureau totaled 2,439,300 kw last June 30. This figure will be raised to 4,863,000 kw if plans for these existing plants are fulfilled. Additional installations planned by Reclamation would raise the agency's capacity to 9,324,000 kw.

Interior Dept's Power Div annual report declared that plants whose energy Interior now markets delivered 18,000,000,000 kwhr of saleable energy during the fiscal year ended last June 30. Total capacity in these plants at the end of the fiscal year was 3,107,300 kw. The three major marketing agencies of the Interior Dept, Bonneville,

ONE *recognized standard*

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FOR GAS CLEANING, smoke abatement and removal of dust, fume, tar and other suspended matter from gas, there has been one universally accepted process for more than thirty years. In answer to your special problem, a Cottrell installation incorporating this rich experience in research, development and worldwide operation means the complete fulfillment of your requirements.

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RECONVERSION TIME is cost-cutting time. Many of the foremost machinery builders are finding that by simply *peeling* precision laminations from Laminum shims, much costly machining is made unnecessary in accurately fitting bearings, gears, etc. These savings are specific, and large enough to be important. Want performance data?

Laminum shims are cut to your specifications. For maintenance work, however, stock shim materials are sold through industrial supply houses.

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LAMINUM
TRADE MARK
THE SOLID SHIM THAT peels FOR ADJUSTMENT

2218

Southwestern Power and Bureau of Reclamation, sold 17,300,000,000 kwhr for a gross revenue of $45,500,000.

The division, according to the report, has also been working with war agencies on disposition of fuel-operated generating plants that have been built to serve some of our large military establishments and war plants. The federal power agencies have had under study acquisition of these plants, which will not be needed for defense purposes after the emergency, as a means of supplementing and firming the hydroelectric power which is now or will be generated by the proposed federal plants. Such coordination of government facilities will result in better operations in areas of irregular steam flow and consequently better financial arrangements, lower rates and greater regional benefits. In some instances, such fuel-operated plants can provide needed peaking or standby power, now bought by government.

New Protected Transformer Serves Bank Secondaries

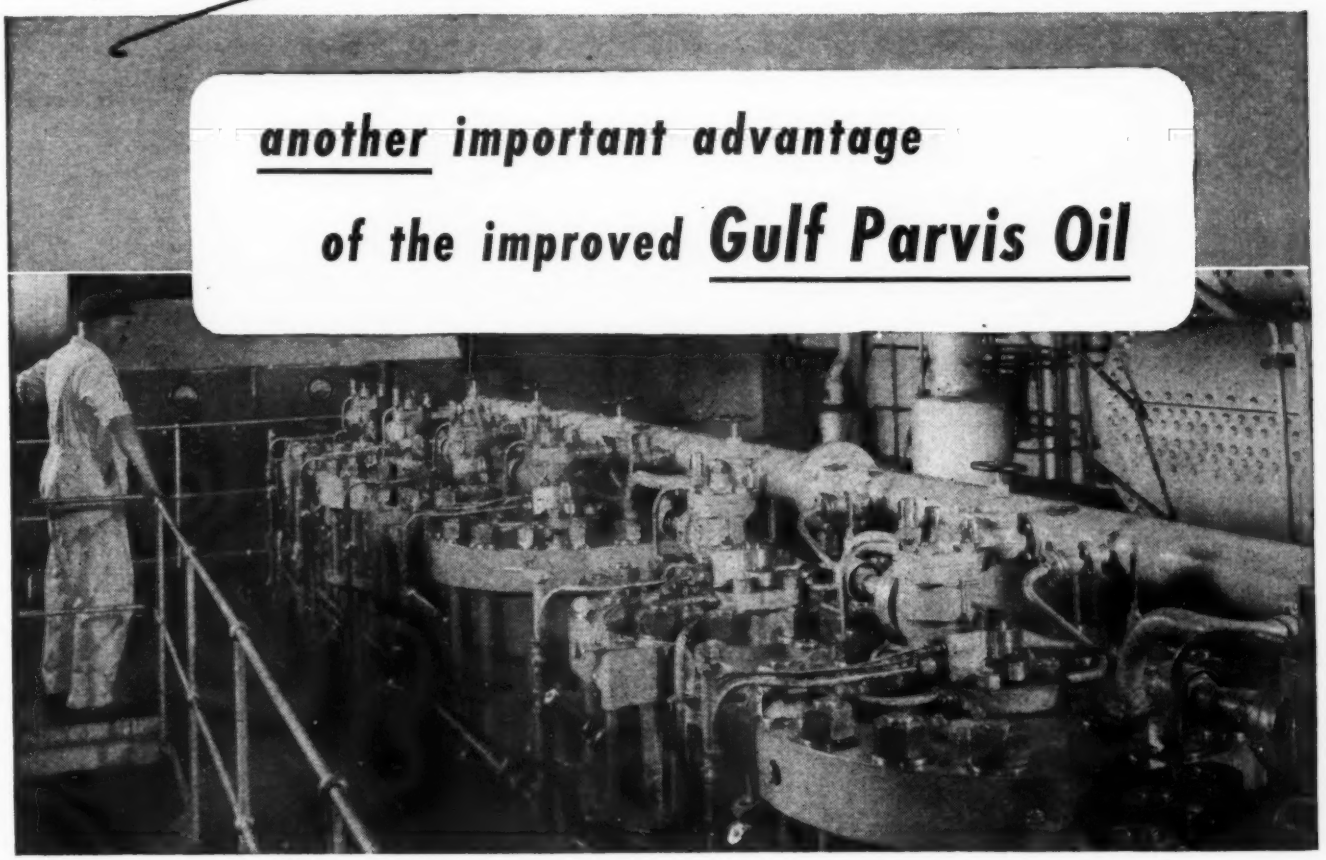
At an editorial luncheon held Feb 6, 1946, at the Astor Hotel, New York City, Westinghouse Electric Corp exhibited and described performance of a new completely self-protected transformer for banked secondary service. This new unit, known as the *CSPB*, has been developed in ratings from 10 to 15 kva, and will be extended to as high as 37½ kva in the near future.

Distinctive features are two 2-pole circuit breakers built into the transformer, which has standard core and coil assembly. These two circuit breakers, mounted side by side on top of the core, feed two secondary circuits that branch out from the transformer. Having the transformer feed two separate circuits through circuit breakers allows a fault to be cleared on either circuit without interrupting transformer service to the other. Overload element of one of the breakers is in series with output from the transformer and in this way controls total load which can be applied before a part is disconnected.

When this transformer is used in connection with the secondary load-distribution system the essential feature is that load circuit is brought into transformer, passes through two circuit breakers and out again. Power from the unit is fed to load circuit between two circuit breakers. This method allows the two transformers adjacent to a fault to disconnect themselves from faulted circuit and continue serving rest of system. A demonstration model was used to show how the transformers would disconnect themselves from the load circuit that had been faulted and maintain service to the rest of the loop system.

Tripped circuit breakers can be reset from a handle that extends through the side of the transformer tank. Mounted integral with circuit-breaker control handle is a red indicating light, which shows when circuit breaker has tripped. This light has another function, which is to indicate when the load has reached about 90% of that required to trip the circuit breaker. This indication shows operator that load on his transformer is reaching an unsafe value before service to the customers is interrupted by tripping of circuit breaker.

Non-foaming—



another important advantage of the improved Gulf Parvis Oil

The two 5,000 h.p. Diesels on this motorship have given uninterrupted service with negligible maintenance costs over a period of many years —thanks largely to efficient lubrication with Gulf Parvis Oil.

THE RECENT DISCOVERY by Gulf Technologists of an effective anti-foam agent is another significant development in the history of petroleum science. This remarkable agent successfully prevents foaming difficulties in lubricants regardless of operating conditions, yet in no way diminishes their lubricating qualities!

You can benefit by Gulf's discovery, for the improved Gulf Parvis Oil contains this new anti-foam agent.

This is just one of the important features of the improved Gulf Parvis Oil. You also get more effective protection of your Diesels through its higher lubricating value, and longer lasting protection because of its greater resistance to oxidation. Call in a Gulf Service Engineer today and ask him to recommend the proper grade of Gulf Parvis Oil to fit your particular requirements.

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Just see how simple they're built!

The fewer moving parts that make up any piece of equipment, the more continuous the service at the lowest operating cost. Fullers are an outstanding example of simplicity of design and construction . . . only three moving parts: rotor—bearings—blades.

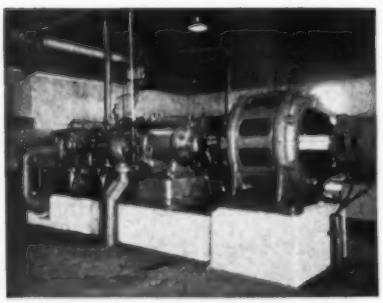
They show remarkable records of continuous performance and, after long gruelling service, if inspection and check-up is desired, the design permits of easy access with a minimum loss of time.

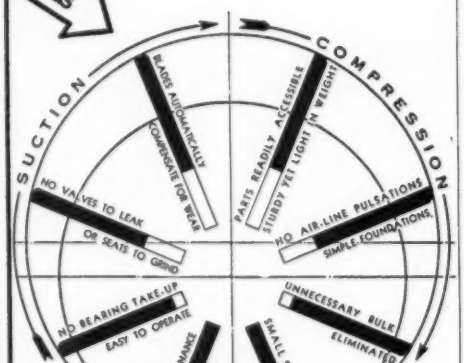
Write for Bulletin C-5.

ROTOR

BEARINGS

BLADES

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COMPRESSION
BLADES AUTOMATICALLY COMPENSATE FOR WEAR
PARTS READILY ACCESSIBLE STURDY YET LIGHT IN WEIGHT
NO VALVES TO LEAK OR SEATS TO GRIND
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C-120

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Notables at Centennial Program of Westinghouse

Charging that "cooperation between employers and employes and between business men and the public has been systematically undermined by government and by labor-union propaganda," Frank D Newbury of Pittsburgh, vice-president of Westinghouse Electric Corp, in an address Feb 26, urged recognition of individual initiative, cooperation of employer and worker, and business leadership as three essentials of a sound national economy. Mr Newbury spoke at a George Westinghouse Centennial dinner, sponsored by American Society of Mechanical Engineers, of which Westinghouse was president. About 100 engineers and industrialists attended the convocation, at the Engineers' Club, 32 W 40th St, New York, N. Y.

"George Westinghouse—the Man and the Engineer" was the theme of the Feb 26 observance. D Robert Yarnall of Philadelphia, president of the American Society of Mechanical Engineers, presided and Dean Dexter S Kimball of Ithaca, N. Y., a past president, was toastmaster. Other speakers included Albert N Williams of Pittsburgh, vice-chairman of board of Westinghouse Air Brake Co, and Dean Samuel W Dudley of School of Engineering, Yale University.

Gwilym A Price, president of Westinghouse Electric, made the first announcement of his firm's centennial program, to be held in Pittsburgh, May 16-18. It will consist of a science and engineering forum, with the participants such world-noted figures as Dr Karl T Compton, president of Massachusetts Institute of Technology; Dr Vannevar Bush, director of Office of Scientific Research Development; Dr Selman A Waksman, discoverer of the new drug, streptomycin; Dr Enrico Fermi of the University of Chicago; Maj Gen Roger B Colton of the Army's radar and electronics program; Dr Frank B Jewett, president of National Academy of Sciences; Charles Kettering of General Motors Corp, and other leaders in the fields of science, engineering and industry.

"Science and Life in the World" will be the theme of the forum, to which 800 guests will be invited.

Annual award of the Morehead Medal was made to Admiral Howard L Vickery, wartime vice-chairman of the U. S. Maritime Commission, by the International Acetylene Association at a dinner at the Metropolitan Club, New York City, recently. The medal was awarded for "eminent leadership in advancing use of the oxy-acetylene processes for the efficient mass-production of ships."

Products of Tomorrow Exposition, scheduled to open at the Chicago Coliseum April 27, has been indefinitely postponed because of the uncertainty of products and delivery schedules of a large number of manufacturers who planned to participate.

John Nooter Boiler Works Co employes honored management with fiftieth anniversary jubilee banquet in St. Louis recently. This banquet was planned by Nooter Booster's Club, an employe organization.

NEW CATALOGS, BOOKLETS, BULLETINS

Bring Your Equipment Library Up To Date With This Convenient Service

CONTROLS, MECHANICAL

1 COMBUSTION CONTROL—Ace Instrument Co, 123 W 21st St, New York, N. Y. 12-page booklet gives features of Ace automatic regulators for combustion control. Photographs and diagrams of equipment are included.

2 FEEDWATER CONTROL—Combustion Control Corp, 77 Broadway, Cambridge 42, Mass. 4-page bulletin No. 103-C covers Fireye boiler feedwater controls. 4-page bulletin No. 102-C presents Fireye photoelectric flame-failure safeguard.

3 TEMPERATURE CONTROL—H-B Instrument Co, 2519 N Broad St, Philadelphia 32, Pa. 16-page catalog describes complete H-B line of temperature controls.

4 LIQUID-LEVEL CONTROL—Northern Equipment Co, 1945 Grove Dr, Erie 6, Pa. 16-page bulletin No. 447, entitled "Feed Water Control System for the World's Largest Forced-Circulation Boiler," discusses the steam-generating unit and feedwater control system at Somerset Station of Montaup Electric Co, Fall River, Mass. 4-page bulletin No. 445, entitled "Controlling Water Level on 675-psi Boilers in Eastern Utility Plant," includes photos and diagrams of an installation.

5 PRESSURE-OPERATED SWITCHES—Meletron Corp, 950 N Highland Ave, Los Angeles 38, Calif. 8-page catalog presents Starbird pressure-operated switches for use in gas, steam, oxygen or oil systems.

ELECTRICAL EQUIPMENT

6 ELECTRONICS—Westinghouse Electric Corp, Box 868, Pittsburgh 30, Pa. 50-page booklet No. B-3726, entitled "Electronics Digest," gives specific electronic applications and includes an explanation of the electron theory and basic electronic devices.

7 MOTORS AND GENERATORS—Electric Indicator Co, Stamford, Conn. 12-page booklet describes ELINCO Type FB motors and generators, designed to allow both base and frame mounting.

8 ELECTRICAL INSULATION—Owens-Corning Fiberglas Corp, Toledo 1, O. 12-page booklet covers properties and test data of Fiberglas electrical insulation materials manufactured by company.

HEAT EXCHANGERS

9 FEEDWATER HEATERS—Swartwout Co, 18511 Euclid Ave, Cleveland, O. 8-page bulletin No. S-18-E describes Swartwout deaerating and standard open feedwater heaters.

10 HEAT ECHANGERS — Griscom-Russell Co, 285 Madison Ave, New York 17, N. Y. 8-page bulletin No. 1230 presents the Fin-Fan exchanger jointly developed by Griscom-Russell Co and Fluor Corp. Bulletin also disucesses the Griscom-Russell K-Fin air-colled section in detail.

11 OIL HEATERS — Whitlock Mfg Co, Hartford 1, Conn. 12-page bulletin No. 35 describes, with complete specifications and capacities, Whitlock fuel oil heaters.

MAINTENANCE AND SAFETY EQUIPMENT

12 STEAM-DETERGENT CLEANING — Oakite Products, Inc, 22 Thames St, New York 6, N. Y. 28-page booklet gives applications of steam detergent cleaning with Oakite solution-lifting guns.

13 SAFETY EQUIPMENT—Mine Safety Appliances Co, Pittsburgh 8, Pa. 178-page catalog No. 6-B covers complete range of MSA safety equipment, including many new products.

14 RIVETS—B F Goodrich Co, Akron, O. 12-page pamphlet, entitled "Why a Rivet Went Nuts," tells about development of B F Goodrich Rivnuts. 36-page 1946 Rivnut data book explains selection of proper Rivnut, installation procedure, tool use and adjustment.

15 STEAM-CLEANING UNIT — Oakite Products, Inc, 22 Thames St, New York 6, N. Y. 6-page folder presents the Oakite-Vapor cleaning unit, a self-contained, downdraft flame, oil-fired, inclosed coil steam generator that delivers hot vaporized cleaning solutions under selective pressures up to 200 psi for removal of grease, grit, grime, paint and other deposits from surfaces.

16 LATHE CONVERTER — Master Mfg Co, Hutchinson, Kansas. 4-page folder describes the Master lathe converter for maintenance repair, tool making, experimental work, etc.

17 SAFETY EQUIPMENT—Davis Emergency Equipment Co, 45 Halleck St, Newark 4, N. J. 8-page technical bulletin No. 1116E on Davis combustible gas alarm system describes principle upon which the system operates, method of operation and a schematic diagram of a typical installation.

18 SUMP CLEANERS AND COOLANT FILTERS — Honan-Crane Corp, 220 Wabash Ave, Lebanon, Ind. 8-page bulletin, entitled "Clean Oil," presents a new line of Honan-Crane sump cleaners and coolant filters.

19 TORQUE WRENCHES—JO Mfg Co, 8442 Otis St, South Gate, Calif. 12-page catalog on line of torque tools gives specifications, applications and suggested torque value tables.

20 KEY KIT—Standard Pressed Steel Co, Jenkintown, Pa. 4-page folder discusses the Hallowell key kit, a compact speed tool with a selected group of essential bits, for driving socket set and cap, Phillips and slotted head screws, etc.

MAINTENANCE MATERIALS

21 MAINTENANCE PAINT—Peninsular Chemical Products Co, 6795 E 9 Mile Rd, Van Dyke, Mich. 4-page bulletin gives complete information on the new Pen-Kote 500 chemical-resistant maintenance paint.

(See other side for additional catalogs)

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Be sure to fill out, completely, one coupon for each piece of literature you order. (See sample below.) This gives your request authority and helps the manufacturer to address your copy completely.

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22 INSULATING CEMENT — Baldwin-Hill Co, 564 Klagg Ave, Trenton 2, N. J. 4-page folder on B-H No. 1 insulating cement provides factual information, tables and charts on efficiency, coverage and ease of application of the product, which is described as an all-purpose thermal insulation.

23 SURFACE COATING — Prima Products Inc, 230 5th Ave, New York 1, N. Y. A1A File No. 7-B-2 covers Aquella, a mineral surface coating that waterproofs and dampproofs interior and exterior porous masonry surfaces, such as concrete, masonry blocks, common brick, etc.

24 SCALE REMOVAL—Chemical Service Dept, International Cementers, Inc, P O Box 5005, Long Beach 5, Calif. 4-page folder discusses the new International chemical service for removing water-deposited sludge and scale from boilers, economizers, condensers, feedwater heaters, cooling jackets, water lines and other similar installations.

MECHANICAL TRANSMISSION

25 GEARS—Abart Gear & Machine Co, 4832 W 16th St, Chicago 50, Ill. 4-page bulletin describes spur gears, bevel gears, worms, worm wheels, helical and spiral gears, internal gears, sprockets and finished machine racks. Abart speed reducers are also included.

26 AUTOMATIC CLUTCH — Salsbury Motors, Inc, 4464 District Blvd, Los Angeles 11, Calif. 4-page bulletin No. 4501 presents the new Salsbury automatic clutch, designed for operating loads up to 6 hp.

27 FLUID DRIVE—Hydraulic Coupling Div, American Blower Corp, Detroit 32, Mich. Bulletin No. 7019 covers Types VS and PE; bulletin No. 7119, Type SC; and bulletin No. 7419, Type T fluid drive.

28 AUTOMATIC CLUTCH—Hardinge Co, York, Pa. 8-page bulletin No. 45 describes BLM Auto-Centri clutch and its applications. Types of clutches and dimensions are included.

METALS AND ALLOYS

29 NICKEL ALLOYS — International Nickel Co, 67 Wall St, New York 5, N. Y. 8-page booklet, revised list "A", covers International Nickel Co's current publications on nickel alloy steels, nickel cast irons, nickel brass and bronzes, and nickel plating. This list includes provision for ordering these free booklets.

30 ALLOY LINE—Ampco Metal, Inc, 1745 S 38th St, Milwaukee 4, Wis. 4-page bulletin No. 72 highlights the Ampco line of alloys, specialties and services.

31 METAL CASTINGS—Austenal Laboratories, Inc, 224 E 39th St, New York 16, N. Y. 8-page booklet, entitled "The Microcast Process," gives a complete explanation of this process of precision casting. Uses in industry include blading and nozzles for gas turbines, steam turbines and power plants, impellers for pumps, etc.

METERS AND INSTRUMENTS, MECHANICAL

32 TACHOMETERS — Chicago Electric Tachometer Co, 800 N Clark St, Chicago 10, Ill. 4-page bulletin No. 12 discusses several models of tachometers suitable for rpm or surface speed measurements.

33 FLOWMETERS—Dept 5-4, Fischer & Porter Co, County Line Rd, Hatboro, Pa. 8-page bulletin No. 45-A explains Rotameter advantages and covers most prominent styles and their uses.

34 INDICATING METER—Davis Emergency Equipment Co, 45 Halleck St, Newark 4, N. J. Circular gives specifications and describes various features of the Stack-O-Meter for indicating CO_2, stack temperature and draft readings.

35 FLOWMETER—Hays Corp, Michigan City, Ind. 8-page bulletin No. 46-766 describes Hays totalizing indicating Veriflow meter for most liquids. Applications are included in this bulletin.

PIPING, FITTINGS, VALVES AND SPECIALTIES

36 VALVES AND OTHER EQUIPMENT —Yarnall Waring Co, Chestnut Hill, Philadelphia 18, Pa. 4-page folder, entitled "What Is Your Boiler Worth," covers Yarway blowoff valves, water columns, gages and indicators for protection of boilers.

37 PIPE COUPLING—Snyder Sales Corp, 5225 Wilshire Blvd, Los Angeles 36, Calif. 4-page booklet describes the All-Flex ball bearing swivel pipe coupling.

38 SAFETY AND RELIEF VALVES—Farris Engrg Co, 400 Commercial Ave, Palisades Park, N. J. Catalog No. 45 includes a pictorial index showing line drawings of all basic Farris valve designs. Directly opposite the pictorial index is a detailed index showing what the valve can be used for and where to find its specifications in the catalog. Supplement to this catalog gives net price of valves.

39 HOSE FITTINGS—B F Goodrich Co, Akron, O. 4-page catalog section No. 3100 discusses hose fittings, including couplings, joints, clamps, washers, nozzles, nipples and flanges. Featured are instructions for properly attaching couplings and other fittings.

40 SOLENOID VALVE—Allied Control Valve Co, South Norwalk, Conn. 4-page bulletin No. 461 presents the Allied V5-200 solenoid valve for use with CO_2, air, water, hydraulic fluids, etc.

41 PRESSURE-REGULATING VALVES —Strong, Carlisle & Hammond Co, 1392 W 3rd St, Cleveland 13, O. 12-page catalog No. 155 covers line of direct-operated and pilot-operated spring-loaded valves for steam, air and gas service. Catalog also contains information on a new fabricated steel separator.

42 PIPE FITTINGS—Stanley G Flagg & Co, 1421 Chestnut St, Philadelphia 2, Pa. 18-page catalog gives engineering data on Flaggseal standard bronze fittings, bronze unions and union fittings, extra-heavy bronze fittings and cast-bronze flanges.

43 CORROSION-RESISTANT VALVES—Alloy Steel Products Co, 1460 W Elizabeth Ave, Linden, N J. Sheet describes new Aloyco 20 valves, fabricated of an alloy resistant to sulphuric acid in a broad range of concentrations and temperatures.

44 SOLENOID VALVES — Automatic Switch Co, 41 E 11th St, New York 3, N. Y. 12-page circular No. 200 discusses ASCO solenoid valves for automatic and remote control of flow of liquids and gases.

PRIME MOVERS AND ACCESSORIES

45 JET PROPULSION—Thompson Products, Inc, 2196 Clarkwood Rd, Cleveland 3, O. 32-page booklet enumerates advantages of jet and reciprocating engines. It describes in non-technical language how a jet engine operates and some of the things science is doing to improve this new source of power.

46 FLOWMETER—Hays Corp, Michigan Gulf Oil Corp, 3800 Gulf Bldg, Pittsburgh, Pa. 20-page booklet, entitled "Gulfcrest Oil for Steam Turbine Lubrication," gives operating characteristics and advantages of this oil. Booklet includes a picture story of the Alchlor process.

47 HIGH-TEMPERATURE CASTINGS—Haynes Stellite Co, Kokomo, Ind. 20-page booklet, entitled "Haynes Precision Castings," describes the Haynes precision casting procedures developed during the war for mass-producing turbosupercharger and jet-propulsion buckets and vanes from alloys that have high hardness and tensile strength at elevated temperatures.

PUMPS

48 VERTICAL AND HORIZONTAL PUMPS—Peerless Pump Div, Food Machinery Corp, 301 West Ave 26, Los Angeles 31, Calif. 4-page bulletin No. E-136 presents sixty types and styles of vertical and horizontal pumps. Types include deep- and shallow-well pumps, Hi-Lift pumps and domestic water systems.

49 SINGLE-STAGE PUMPS — Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y. 20-page catalog, Form No. 7057, covers design, construction and other engineering details of Cameron single-stage general-service pumps.

50 TURBINE DEEP-WELL PUMP—Worthington Pump & Machinery Corp, Harrison, N. J. 4-page reprint No. RP-277, entitled "Influence of Ground-Water Level on Turbine Well Pump Performance," by P J Equi, explains loss in output caused by receding level of underground water. Author illustrates remedy for such a condition by a typical example.

51 ROTARY PUMPS—Blackmer Pump Co, Grand Rapids 9, Mich. 8-page bulletin No. 307 includes a description of a new removable liner which is standard construction now in Blackmer power pumps.

52 HIGH-PRESSURE PUMPS—Worthington Pump & Machinery Corp, Harrison, N. J. 6-page bulletin No. W-414-B44 gives construction, specifications, installations and sizes of VTE power pumps.

WATER TREATMENT

53 WATER ANALYSES—W H & L D Betz, Gillingham & Worth St, Philadelphia 24, Pa. 44-page booklet, entitled "Apparatus and Chemicals for Water Analyses," features test sets required for such determinations as hardness, alkalinity, phosphate, sulphate, dissolved oxygen, pH, silica, and others. In addition, numerous comparators, photometers, turbidimeters, etc, are illustrated.

54 pH EQUIPMENT—Bristol Co, Waterbury 91, Conn. Bulletin describes line of pH control instruments. Bristol continuous pH controllers and recorders are discussed in detail, including electrode assemblies and accessories.

(*Continued on page* 170)

FIRST CLASS
PERMIT No. 10
(Sec. 510, P.L.&R.)
NEWYORK, N.Y.

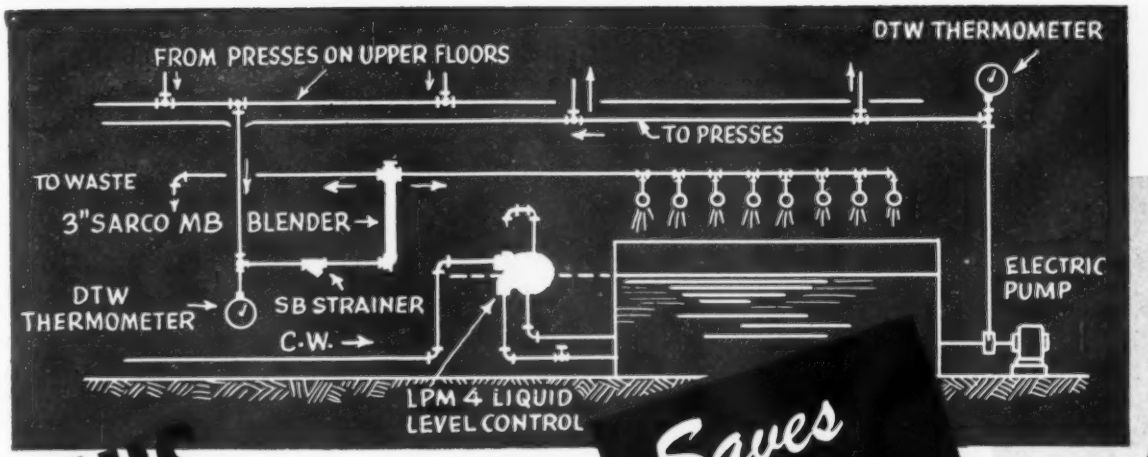
BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

4c Postage Will Be Paid By—

POWER

330 West 42nd Street

New York 18, N. Y.



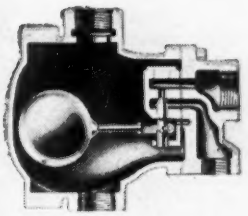
THIS SARCO HOOK-UP . . .

Saves $500 a month

The Sarco Blender is an automatic three-way valve that recirculates and controls temperatures.

A large plastics plant in New York uses a great number of hydraulic presses, which formerly were cooled by a 3-inch city water main running at full pressure with the returning water at 80 degrees.

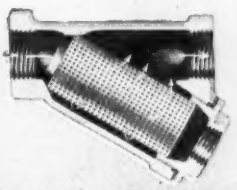
The plumbing contractor decided that something drastic and permanent should be done so he called in the Sarco representative, who recommended the circulating system shown above. Three little inexpensive Sarco products did the job and the monthly water bill of more than $500 has been reduced to $12 to $15 per month.



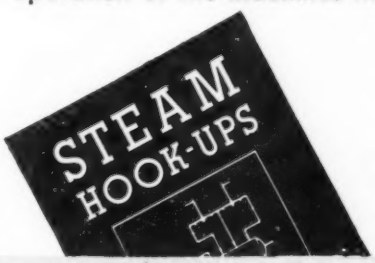
The Sarco liquid level controls are as simple as a float trap.

IT CAN HAPPEN IN YOUR PLANT!

Perhaps not to such a degree. Perhaps it's only a small loss of water multiplied at many spots, mostly invisible. But the Sarco devices used for recirculation and temperature control of tanks, engine jackets, brine coils, condensers, etc., cost so little that even a trickle of wasted water will pay their cost in a few months. The big saving is in the more efficient and reliable operation of the machines they control.



Sarco strainers are used to protect equipment, to clean river water, and strain oil, syrups, etc.



Many ways to save are shown in the Sarco Hook-Up Book and Sarco Catalogs. Many others applying specifically to your plant are available through the Sarco representative near you.

106

FOUR STARS ON OUR E PENNANT TESTIFY TO SARCO PERFORMANCE IN THE WAR EFFORT

SARCO SAVES STEAM

Represented in Principal Cities

SARCO COMPANY, INC., 475 FIFTH AVE., NEW YORK 17, N.Y. • Sarco Canada, Ltd., 85 Richmond St., W., Toronto 1, Ont.

PRESSURE, TEMPERATURE, FLOW, ELECTRICAL AND LEVEL MEASURING INSTRUMENTS

UNITED STATES GAUGE

6 out of 10 manufacturers of original equipment specify U.S.G.

DIVISION OF AMERICAN MACHINE AND METALS, INC.

SELLERSVILLE, PENNSYLVANIA (15)

Coal Storage a 1-Man Job
with the
SAUERMAN SYSTEM

Above is a small Sauerman Scraper System handling a stockpile at a power plant serving two textile mills. With this simple installation, one man is able to stock out a large train-load of coal in a few days' time and then reclaim at regular intervals whatever tonnage the plant requires. This Sauerman unit has operated steadily for 14 years—never has demanded much attention or repairs—will continue to give the same dependable service for many years to come.

Compact Piling • Safer

AT A GREAT SAVING!

Whether your annual coal storage requirements amount to only a few thousand tons or a million tons, there's a size and type of SAUERMAN Scraper System to take care of your storing and reclaiming cheaper and with less manpower. But that's not all. It makes best use of available space by building high piles in compact layers—leaves no airpockets for spontaneous combustion—reduces dust and dirt. One man easily handles it with one set of automatic controls. Low initial cost. Upkep simple.

Send for Sauerman Catalog.

SAUERMAN BROS., Inc.
562 S. Clinton St., Chicago 7, Ill.

New Bulletins

(*Continued from page* 168b)

55 WATER SOFTENERS—Elgin Softener Corp, Elgin, Ill. 20-page bulletin No. 607 covers Elgin water softeners and other water-conditioning equipment.

56 FEEDWATER CONTROL—Northern Equipment Co, 1945 Grove Dr, Erie, Pa. 24-page bulletin No. 441 presents Copes feedwater control for high-duty boilers.

WELDING

57 ARC-WELDING — Hobart Bros Co, Troy, O. Folder DM-710 describes Hobart arc-welding electrodes. Folder DM-709 covers arc-welding accessories.

58 POSITIONING EQUIPMENT—Industrial Div, Ransome Machinery Co, Dunellen, N. J. Folder gives outstanding features of Ransome positioning equipment for welding assembly, repair, etc.

59 FLASH WELDER—Progressive Welder Co, 3050 E Outer Dr, Detroit 12, Mich. 8-page bulletin describes new line of Progressive standard flash welders.

60 FLAME CUTTING OUTFIT—Victor Equipment Co, 844 Folsom St, San Francisco, Calif. 4-page bulletin No. 69 presents the Victor pack emergency flame cutting outfit.

OTHER EQUIPMENT

61 REFRIGERATION AND AIR-CONDITIONING EQUIPMENT—Frick Co., Waynesboro, Pa. 32-page bulletin No. 80-B discusses Frick refrigerating, ice-making and air-conditioning equipment.

62 FANS AND BLOWERS—National Association of Fan Manufacturers, 5-208 General Motors Bldg, Detroit 2, Mich. 12-page booklet, entitled "Standards, Definitions, and Terms in Use by the Fan and Blower Industry," consolidates in one publication all of the standards generally recognized and accepted by the industry.

63 AIR SEPARATOR — Swartwout Co, 18511 Euclid Ave, Cleveland 12, O. 4-page bulletin No. S-13 describes the AIR-FUGE, a new separator for removing moisture, oil, scale, etc, from compressed air.

64 WATER EJECTOR—National Pneumatic Co, Rahway, N. J. Bulletin No. DC-25 gives installation, operation and advantage of automatic water ejector No. DC-35100 for compressed air systems.

65 POWER-FACTOR REGULATOR — Modern Control Equipment Co, 176 W Adams St, Chicago, Ill. 4-page folder tells about the Haug System power-factor regulator.

66 HEAT INSULATION — Philip Carey Mfg Co, Lockland, Cincinnati 15, O. Revised catalog, entitled "Heat Insulation for Industry," covers magnesia, asbestos, sponge, diatomacious earth, calcined aggregate, mineral wool, corrugated asbestos types of insulation. Insulating, bonding and refractory cements are also discussed.

67 CONVEYORS—Robins Conveyors, Inc, Passaic, N. J. 16-page bulletin No. 127 gives description and operation of Robins mine conveyors. Robins district offices and sales agents are included.

68 CONVEYOR TROLLEY—Link-Belt Co, 307 N Michigan Ave, Chicago, Ill. 4-page folder No. 2041 announces a new free-rolling conveyor trolley.

69 INSTRUMENTS—James G Biddle Co, 1211 Arch St, Philadelphia, Pa. 4-page bulletin No. 1805 describes three different types of Megger instruments for measuring low resistance. These include the Bridge-Meg resistance tester, Ducter low-resistance ohmmeter and midget Megger circuit-testing ohmmeter.

70 PLASTIC COMPOUNDS — Bakelite Corp, 300 Madison Ave, New York 17, N. Y. 19-page booklet, entitled "Vinylite Plastics—Elastomeric Compounds," shows how these compounds have improved already established applications or made possible new applications.

SHAW

KNOWN SINCE 1893 FOR HIGH-QUALITY

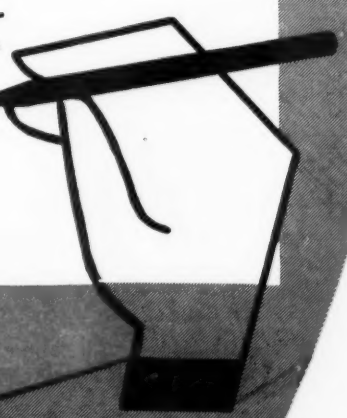
DEPENDABLE PIPING

Pre-Fabrication & Piping Installation

Benjamin F. Shaw Company is qualified to prefabricate and erect piping—any place in the United States and Canada.

Ben. F. Shaw II

PRESIDENT

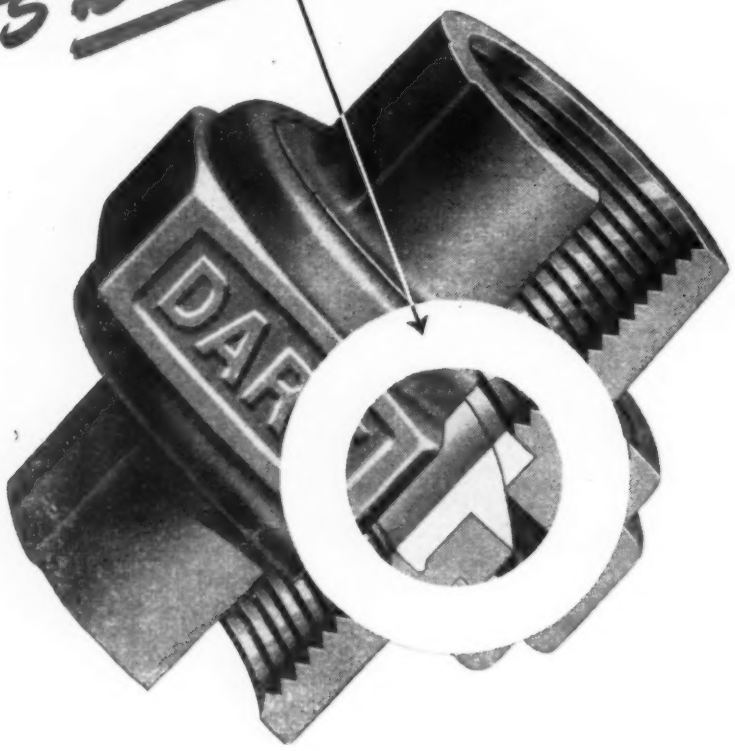


BENJAMIN F. SHAW COMPANY

2nd and Lombard Streets • Wilmington 99, Delaware

IF IT HAS 2 BRONZE SEATS GROUND TO A TRUE BALL JOINT

It's Definitely a Dart



This feature distinguishes a Dart Union from all others—it has two bronze seats ground to a true ball joint. That means it will close easily to a leakproof connection, and open as easily if you have use for it elsewhere.

And it's hard to damage a Dart, for body and nut are made of high-test, air-refined malleable iron.

In length of service, Darts cost least. Ask your supplier.

DART UNIONS

E. M. DART MFG. CO., PROVIDENCE 5, R. I.

Chinese Study Methods of U. S. Industrial Plants

China is going to get the benefit of Pittsburgh developed combustion-control methods used by industry in America. Peng Hung, one of a large group of technically trained Chinese getting on-the-job experience in American know-how, has arrived recently for a special training course in combustion control under Hagan Corp engineers. As with his countrymen who have been carefully picked for ability before being sent to the U. S., Mr Peng has graduated from a university in China and is spending some time in a number of different industries to learn latest methods in construction and operation of industrial plants.

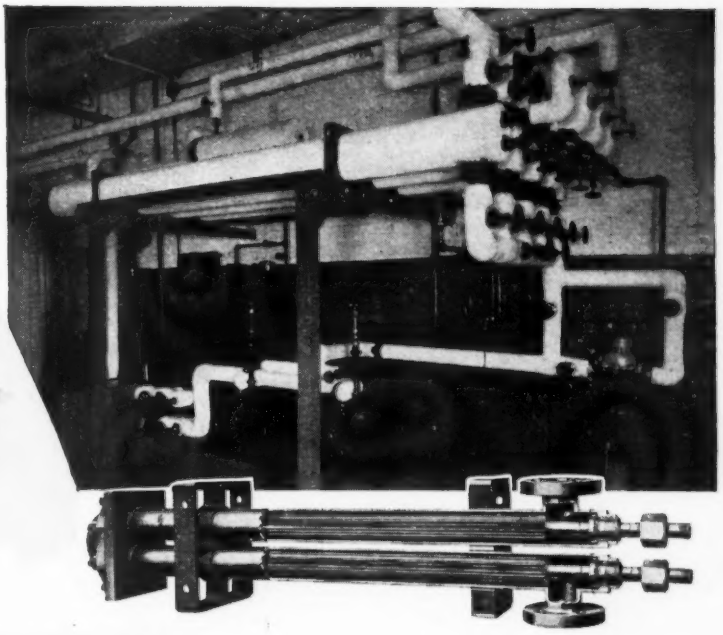
To date practically a cross-section of American industry is participating in the training of some 1000 qualified, English-speaking Chinese now in the country. All expenses of students, including housing, are paid so that no firm giving training is put to any expense except for time. Students draw $150 per month for subsistence, paying the rest from their own pockets.

Arrangements for Mr Peng's stay in Pittsburgh were made by Hilton C Smith of the International Training Administration, Inc, a nonprofit organization whose president is Elliott S Hanson.

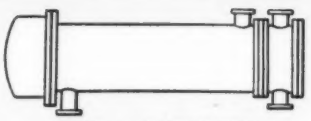
Sessions dramatizing the impact of atomic power upon civilization will feature the 109th national meeting of the American Chemical Society at Atlantic City, N. J., April 8-12. Program will include a broad survey of nucleonics, the new field of scientific endeavor dealing with release of energy from nucleus of the atom, under chairmanship of Dr Glenn T Seaborg, co-discoverer of plutonium, one of the atomic bomb's bases, and also of elements 95 and 96. Dr Seaborg, a University of California chemistry professor, is in charge of plutonium research for Manhattan Project at University of Chicago Metallurgical Laboratory. Nuclear power's far-reaching implications for mankind will be emphasized by an exhibit on the harnessing of this new form of energy, its use in the atomic bomb and its potential service in science and industry.

First membership list of Thomas A Edison Centennial Committee, now in formation and comprising world leaders in fields of science, education and industry, was announced recently by National Chairman, Dr Charles F Kettering. The 100th anniversary of the birth of Edison will fall on Feb 11, 1947, and the committee, during the centennial year, will coordinate interest in commemorating the attainments of this great inventor. Edison Pioneers, an organization of men and women closely identified with early work of the inventor and sponsor of the Centennial Committee, ushered in the centennial year with a luncheon on Feb 1, 1946, the 99th anniversary of Edison's birth. The luncheon was held at Hotel Astor, New York City, and featured an address by Gano Dunn, eminent electrical engineer and Edison Pioneer, and a demonstration of fluorescent lighting and its myriad applications.

TWIN G-FIN SECTION FUEL OIL HEATER



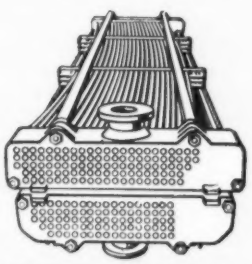
ONLY G-R BUILDS THIS WIDE VARIETY OF HEAT TRANSFER APPARATUS



SHELL and BARE TUBE
Heaters, Coolers, Condensers, Heat Exchangers

G-FIN
Longitudinal-finned elements for greater heat conductivity

K-FIN
Helical-finned elements for vapors and gases



BENTUBE EVAPORATOR
Scale-shedding Elements

TUBEFLO SECTIONS
Non-clogging design for residuum and other dirty fluids

Simple

Just a pipe within a pipe—that's the principle of the Twin G-Fin Section. The G-Fin inner pipe, through which the steam passes, has longitudinal fins to provide greater surface for transfer of heat to the oil flowing through the outer pipe.

Readily Installed

The Twin G-Fin Section is easily handled, and can be placed close against a wall, ceiling or floor . . . wherever most convenient. Movable supports further assist convenient installation.

Easy To Clean

The G-Fin heating elements or pipes may be completely removed from the shells for cleaning, without disturbing the oil connections. No special tools are required.

Flexible Capacity

These units are standard and interchangeable. They may be arranged in series or parallel; and at partial loads, sections may be cut in and out to maintain constant oil temperature.

Compact

The longitudinal G-Fins provide at least six times as much heat transfer surface as bare tubes . . . the result: the Twin G-Fin unit has fewer tubes than any other type of heater.

Leak-proof

Leakage between steam and oil cannot occur because there are no internal joints.

For complete description of this superior fuel oil heater, write for our Form 714.

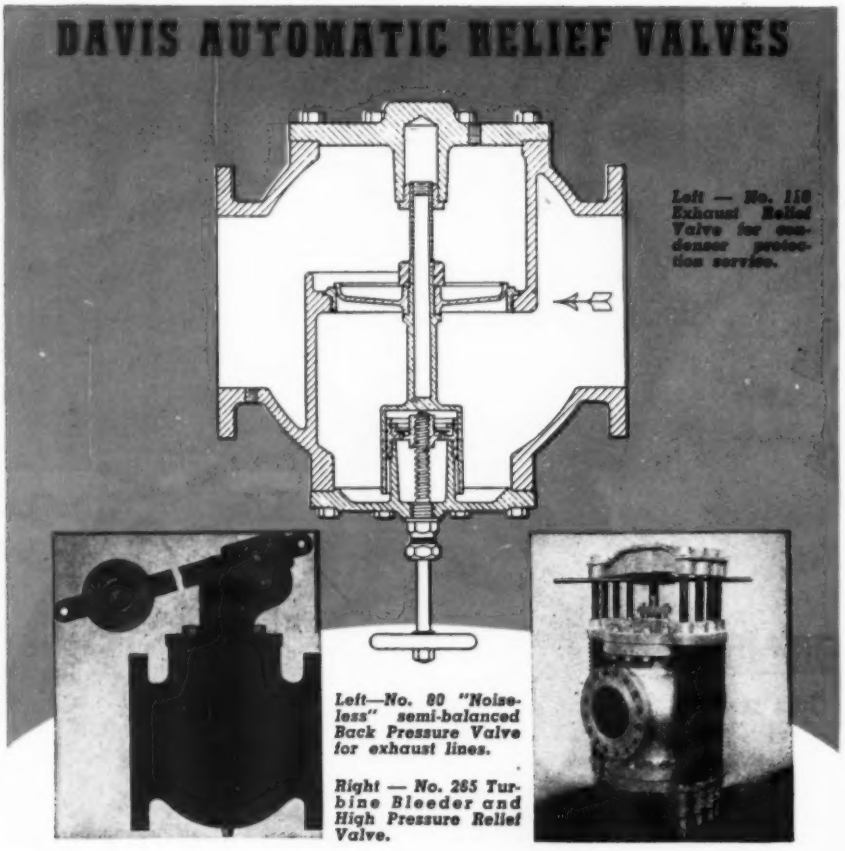
THE GRISCOM-RUSSELL CO.

285 Madison Ave., New York 17, N. Y.

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus

DAVIS AUTOMATIC RELIEF VALVES



Left — No. 110 Exhaust Relief Valve for condenser protection service.

Left—No. 80 "Noiseless" semi-balanced Back Pressure Valve for exhaust lines.

Right — No. 265 Turbine Bleeder and High Pressure Relief Valve.

No power plant valve is more important

In 69 years of specialization on power plant automatic valve specialties, Davis has brought the atmospheric exhaust relief valve to a high point of perfection, with a combination of engineering features not found elsewhere.

Let's look inside the No. 110: The bronze-to-bronze-contact valve is water-sealed through inlet and overflow pipe connections in the body. Valve action is cushioned by a closed-top internal dash pot eliminating sticking of valve due to foreign matter. Flapper valve permits quick opening, slow closing movement. There is full pipe area through the port and all body passages. The valve holds tight under high vacuum, and relieves to atmosphere at a fraction of a pound pressure when vacuum is lost.

Hand lifts, top or bottom, or hydraulic cylinders permit testing the action and holding valve open when desired.

Angle designs available as well as horizontal and vertical, also valves that will function as a relief valve part of the time and back pressure valve at other times, or with hold-open attachment so that valve must be closed manually once it has relieved.

Let us help you on automatic valve problems for steam . . . air . . . gas . . . water . . . and oil.

Ask for ENGINEERING BULLETIN NO. 101 A

DAVIS REGULATOR COMPANY

2540 S. Washtenaw Ave., Chicago, Ill.

DAVIS REGULATOR COMPANY

APPOINTMENTS

Arthur J Olson, formerly district sales engineer for **Link-Belt Co** at Chicago, has been appointed district sales manager at Kansas City, Mo., to succeed Max Giffey, who has resigned after 40 years' service with the company. Mr Olson will be assisted by J Arthur Townsend and Leroy C Rathsam, district sales engineers.

Edward Valves, Inc, promotes Raymond A Durand to position of sales manager.

Lincoln Electric Co appoints R H Davies as consulting engineer in charge of the educational work of the company.

Wilmot F Wheeler has been made president of **American Chain & Cable Co,** succeeding the late William T Morris. Cyrus N Johns becomes executive vice-president, and Stanley Mann, treasurer. Helicoid gage div appoints Lytle Engrg Co as its representative on Helicoid gages in Cleveland, O.

Westinghouse Electric Corp names Frank D Newbury as a member of board of directors. L E Osborne was named senior operating vice-president, responsible to the president for all manufacturing units of the company. William G Miller has been appointed manager of the headquarters manufacturing staff at Pittsburgh, Pa. Carl E Nagel has been made manager of editorial service. R W Gemmell becomes manager of aircraft sales dept of small motor div, Lima, O., succeeding N C Reed who was transferred to elevator div in Jersey City.

Appointment of William B Meek as assistant general manager of **Westinghouse Electric Supply Co,** with Robert P Smith as his successor in managership of Midwest district, with headquarters in St. Louis, has been announced. Douglass B Williams has been named manager of East Central district, with headquarters in Pittsburgh, Pa. W I Bickford, whom Mr Williams succeeds, will remain in a consulting capacity until his retirement at the end of June. Earl E Morton was named Northwestern district appliance manager, with headquarters in Chicago. Ray B Mowe becomes manager of WESCO branch at Fort Wayne, Ind. Transfer of Ralph H Sroufe to Portland, Ore., as manager of Westinghouse Electric Supply Co in that city has been announced. Robert T Rogers will succeed Mr Sroufe at Des Moines. John G Lee has been appointed manager of Sioux City, Iowa, branch.

Precision Thermometer & Instrument Co announces election of Carl H Waser as president and treasurer.

Delavan Engrg Co. has been appointed to handle the power piping div account of **Blaw-Knox Co** in states of Iowa and Neb., and also in Rock Island County, Ill.

J P Henry becomes Eastern zone manager in charge of district engineering offices of **Ampco Metal, Inc,** in Hartford, Conn.; Newark, N. J.; Philadelphia, Pa.; and Washington, D. C. Zone headquarters have been transferred to Room 624, Capitol

Trying to Stoke a Furnace with a Teaspoon?

It's just as unwise to expect out-of-date wiring to fully serve modern electrical equipment

Wire ahead!

PRODUCTION LOSSES through obsolete wiring service can run from 25% to 50%...regardless of machine production ratings!

Guard against this needless waste ... protect your investment in new, advanced electrical equipment ... make sure expanded power loads won't exceed your power sources.

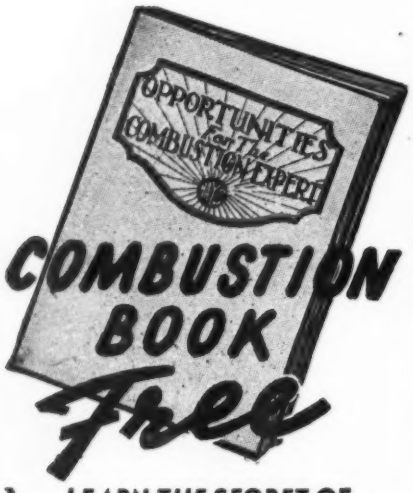
Today, put in a call for your consulting or plant power engineer—or for your electrical contractor or power salesman. A discussion with him now may save you many thousands of dollars in emergency alterations, shutdowns later. Anaconda Wire & Cable Company, Subsidiary of Anaconda Copper Mining Company, 25 Broadway, New York 4, N. Y. Sales offices in Principal Cities.

Look to Anaconda for wire and cable controlled from copper ore to finished product by Anaconda basic research and engineering. Every Anaconda product is a lasting investment . . .

Check your wiring plans before they check you!

DON'T BE PENNY-WISE AND POWER-FOOLISH

ANACONDA **ANACONDA WIRE & CABLE COMPANY**



LEARN THE SECRET OF BIG EARNINGS IN

COMBUSTION ENGINEERING

There are plenty of big jobs today in Combustion Engineering. Such jobs have always been big pay jobs —and today they are better than ever. High fuel and equipment costs means a greater demand for combustion trained men than ever before.

Do you want such a job? You can have it—if you will train for it. And that is *easy to do.* Just a little of your spare time is required for the simple, easy-reading, practical Hays Home Study Course in Fuel and Combustion engineering.

A few of our friends whose employees have advanced through Hays training:

- International Harvester Co.
- Armour & Co.
- Combustion Engineering Co.
- Riley Stoker Corp.
- Iron Fireman Mfg. Co.
- Commonwealth Edison Co.
- State of Illinois Cities Service (Oil & Power)

and many others.

For 28 years we have specialized exclusively in such training. Today, Hays trained men are more in demand than ever. Now is the time to do what hundreds of others have done who hold substantial positions of responsibility today.

Write for Free Book Now!
Don't Delay! Mail Coupon Today!

You can't lose by getting the facts. We'll send our book, "Opportunities for the Combustion Expert" without obligation or expense to you. Learn how every lesson is administered by trained practical staff men who give the utmost in help and guidance. Get complete outline of course. Learn how to become a key man in Combustion. Send in the coupon now!

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Please send me your Free Book "Opportunities for the Combustion Expert"—No obligation.

Name.....

Address.....

City..... State.....

Company Name.....

National Bank Bldg, Hartford 3, Conn. Newark district office will be handled by A M Smith and J W Nebel. W F Taff has been transferred from Cincinnati to Indianapolis as field engineer, working with F A Burnett, district manager.

Appointment of Edgar P Hollister as manager of New York factory branch was recently announced by **General Controls Co.**

G H Gaites has been made district manager of the **Bristol Co's** New York office.

A I McFarlan, formerly vice-president of Kerby Saunders, Inc, is now president of **A I McFarlan Co,** engineering designers and contractors in air conditioning, heating and refrigeration.

Fairbanks, Morse & Co appoints C L Richard special representative of scale div and E L Stine supervisor of scale service. Both men will be in Chicago. Leonard J Maguire has been promoted to assistant chief engineer at St. Johnsbury, Vt.

Ernest J Joss has been assigned to general offices of **United States Rubber Co** in New York City as administrative assistant to Ernest G Brown, vice-president and general manager of mechanical goods, general products and Lastex yarn and rubber-thread divisions.

Stuart E Halliday has joined **Consolidated Diesel Electric Corp** to supervise sales and advertising. On March 1, company moved to their new plant at 230 E 8th St. Mt. Vernon, N. Y. They retain their branch offices in Chicago and Washington, D. C.

Detroit diesel engine div of **General Motors Corp** announces appointment of King D Boyd as district manager of petroleum industry sales in Gulf Coast region.

Grinnell Co announces transfer of Thomas H Dawson Jr to Providence from Atlanta, Ga., as manager of supply sales dept for the Providence territory covering New England and eastern New York State.

A J Kerr has been elected vice-president of sales of **Rockwell Mfg Co.**

Resignation of George P Torrence, president, and John S Clark, vice-president and treasurer, of **Cleveland Pneumatic Tool Co** was announced.

Potter & Brumfield Sales Co has been incorporated in state of Ill. to handle all domestic and export sales of relays, process timers and electromechanics manufactured by **Potter & Brumfield Mfg Co,** Princeton, Ind. An office has been opened in Chicago and sales company operation will be in charge of Ralph T Brengle, president.

Eastern Gas & Fuel Associates, Koppers coal div, has appointed Charles H Sawyer research engineer. Mr. Sawyer will supervise Koppers coal div service to customers using or selling coal for heating purposes, as provided through Koppers coal div's district service representatives. He will coordinate this work with that of Koppers

NCC

SLUDGE SOLVENT

has ended sludge troubles for factories, railroads and ship lines

Sludge follows oil like mud follows rain—regardless of the quality of the oil.

The harmful effects of sludge start in the tank, go through the feed lines and burner, right up into production —particularly if temperature or atmosphere control are important.

Frequent shut-downs to clean sludge-fouled parts are only the beginning of sludge troubles. Neglected, sludge accumulates to the point where parts may even have to be replaced.

Ridding yourself of sludge is easy and inexpensive. To your next load of fuel, just add NCC SLUDGE SOLVENT, the tested, scientifically prepared fuel oil conditioner.

NCC dissipates water and other impurities. NCC liquefies sludge already formed; cleans and keeps clean dirty tanks, clogged nozzles, clogged feed lines, dirty strainers, carbonized pre-heater coils, dirty burner tips, etc.

NCC does not harm metal, is non-inflammable, neutral and acid-free and does not affect the flash point of oil. Send trial order or write for bulletin, "Management Knows the Facts of Life."

NUTMEG CHEMICAL CO.
223 State St., New Haven 10, Conn.

"TARGET" GASKET SHEET
TRADE MARK REG.
"COMPRESSED ASBESTOS"
FOR YEARS YOU HAVE SOUGHT IT . . .
NOW HERE IT IS . . . AN
ALL-PURPOSE GASKET SHEET!
THE ANCHOR PACKING CO.

SHEET SIZES
50" x 50"
50" x 150" — 1/32" to 1/4" thick
TEMPERATURE RANGE
0° to 700° F
Stands all reasonable pressures

● "TARGET" Gasket Sheet is an all-purpose gasket material. Adopt it for your gasket requirements and you will not worry whether the apparatus on which it is used is sealing against steam — air — water — oil — gasoline — or other solvents.

We urge you to make "Target" your universal Gasket material and eliminate unnecessary Gasket complications. Write today for full details.

Remember the name — "Target". It's a Bulls-eye for your Gasket troubles.

THE ANCHOR PACKING COMPANY

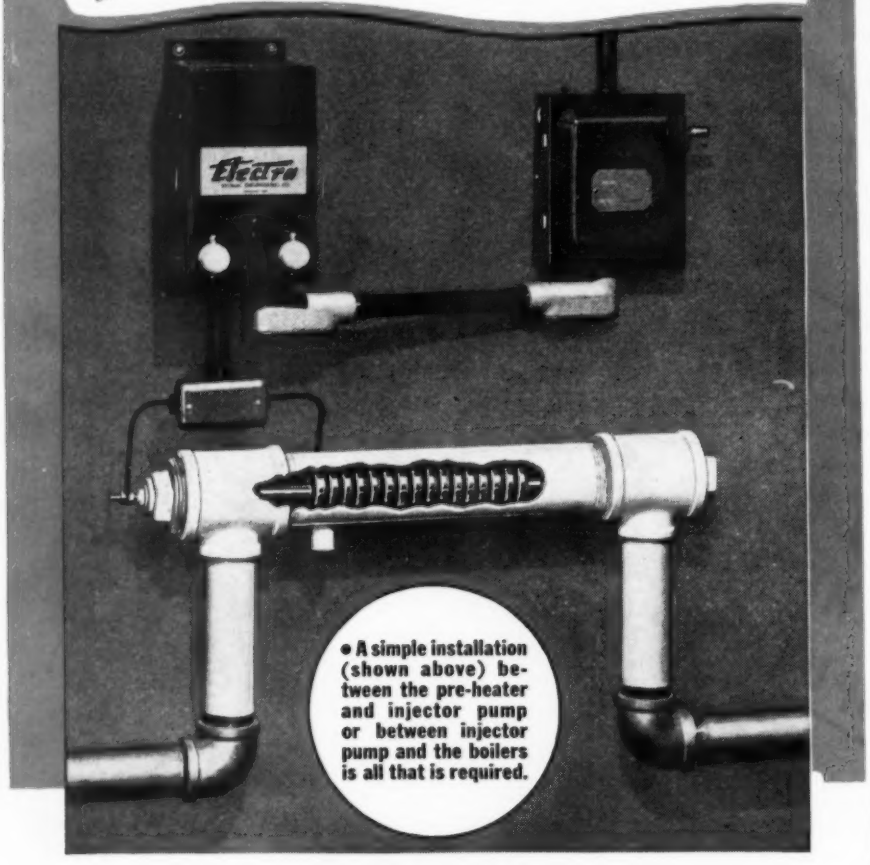
GENERAL OFFICES: PHILADELPHIA 8, PA.

FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

BRANCH OFFICES

Baltimore 2, Maryland	106 Stewart Bldg., Gay and Lombard Streets
Boston 14, Massachusetts	303-04 North Station Building 150 Causeway Street
Buffalo 2, New York	Andrews Building
Cleveland 13, Ohio	523-25-27 Rockefeller Building
Columbus 9, Ohio	172 North Cassingham Road
Chicago 11, Illinois	230 East Ohio Street
Cincinnati 2, Ohio	4 West 7th Street
Detroit 26, Michigan	169 West Jefferson Avenue
Houston 2, Texas	509 Washington Avenue
Kansas City 6, Missouri	1332 Oak Street
Los Angeles 21, California	720 Mateo Street
Montreal 20, Canada	5575 Cote Saint Paul Road
Milwaukee 2, Wisconsin	903 East Kilbourn Avenue
New Orleans 4, Louisiana	418 Common Street
New York 13, New York	100 Sixth Avenue, near Canal
Philadelphia 8, Pennsylvania	401 North Broad Street
Pittsburgh 22, Pennsylvania	405 Penn Avenue
Portland 1, Oregon	1433 S. W. Front Avenue
San Francisco 7, California	156 South Park
Seattle 4, Washington	2207 First Avenue, South
St. Louis 3, Missouri	1407 Pine Street
Tulsa 4, Oklahoma	823 South Gary Place
Wilmington, California	524 North Avalon Boulevard

Eliminate Scale and Corrosion with Electro WATER CONDITIONER


Electro
• A simple installation (shown above) between the pre-heater and injector pump or between injector pump and the boilers is all that is required.

Electro

Somewhere along the production or processing line you will find a use for the ELECTRO WATER CONDITIONER. It is adaptable to the following industrial applications:

- Pre-heaters
- Boilers
- Condensers
- Cooling systems
- Hot water tanks
- Compressors

Prevents lime deposits and scale formation. It also prevents corrosion, foaming, priming and bumping. Embrittlement and cracking are thus alleviated. Pitting is unknown after an *Electro* installation.

Eliminates the use of boiler compounds and chemicals with their periodic cleaning shutdowns. Algae and foreign growths are stopped immediately. A semi-monthly cleaning takes only fifteen or twenty minutes.

Reduces fuel costs and maintenance expense. It reduces to a minimum the number and the length of shutdowns for cleaning boilers and lines. Reduces depreciation of lines, systems and equipment.

STOMAC ENGINEERING CO. Inc.
2012 W. 25th St. · Cleveland 13, Ohio.
Branch Offices: 726 Empire Building, Milwaukee 3, Wisconsin — 506 S. Wabash Ave., Chicago, Illinois

stoker-coal research laboratory. He will also handle research in coke and gas industry in collaboration with general research activities of Eastern Gas & Fuel Associates. Paul J Stein has been made industrial service engineer. He will specialize on recommendation of coals for industrial and utility steam-generating purposes. He will also supervise service offered by engineers in district offices of Koppers.

Russell L Peck has been appointed refractories engineer by **Norton Co**. He will work with F E Leiby and will cover Philadelphia, Delaware, eastern Maryland, eastern Virginia and eastern North Carolina.

Eagle-Picher Sales Co names Oscar A Mockridge to chemical engineering development staff of insulation div.

Russell W Boettiger has been made sales manager of **Leslie Co.**

Elgin Softener Corp announces that Norman E Tucker has joined industrial sales div, Donald Woollard the industrial engineering staff, and Charles L Caldwell the service dept. Following additions to laboratory staff have been made: Glen Swanberg joined company as an analytical chemist and Clifford Skoning on chemical research staff. Richard Hawthorne has been appointed analytical supervisor.

William Van C Brandt resumed his former position as manager of Exide motive power sales for **Electric Storage Battery Co,** Philadelphia, after serving in Navy.

John R Purser Jr and John B London announce formation of Purser & London, Inc, sales engineers. The new firm will operate in North and South Carolina as representative of **Yeomans Bros Co,** Chicago.

International Nickel Co opened a St. Louis technical section of its development and research div. International Nickel Co of Canada, Ltd, formed a development and research section at 25 King St W, Toronto, Canada. This section will be staffed by Gordon S Farnham, A S Tuttle and H J Butterill. Function of this section will be to extend to Canadian industry a complete consulting and technical service on metal problems.

Weston Electrical Instrument Corp, Newark, N. J., appoints Russell Ranson, 116½ E 4th St, Charlotte 2, N. C., as sales representative for Va., N. C. and S. C.

Election of Robert W Cornell as comptroller of **Parker Appliance Co** was announced. He succeeds Oliver W Berndt, who has resigned. Following firms have been appointed as distributors of Parker industrial fittings and tube-bending equipment: Whitehead Metal Products Co, New York, Boston, Buffalo, Newark and Philadelphia; Williams & Co, Pittsburgh, Cleveland and Cincinnati; A E Borden Co, Boston; Carey Machine & Supply Co, Baltimore; Louis H Hein Co,

Remember this Fact—
Wet Coal Won't Clog
This Stoker!

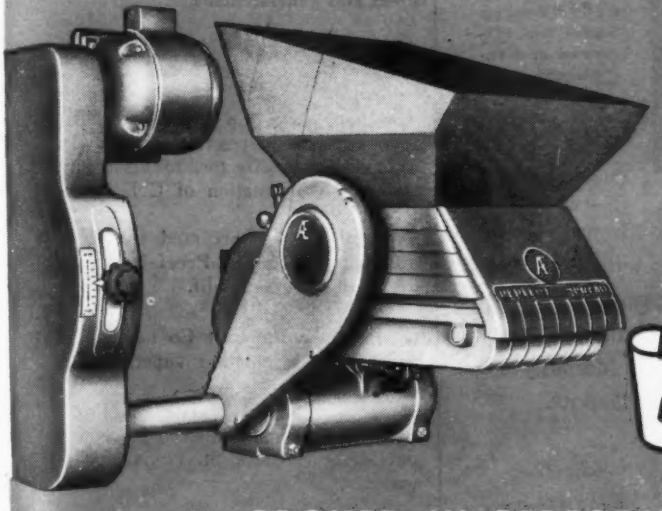
Of all the features, of all the extra advantages of the Perfect Spread Stoker this ONE is outstanding. Yes, we repeat—*wet coal won't clog this stoker!* Fill the hopper with the lowest grade coal available—wet, partially frozen or dry—and you get *continuous* feeding for the most efficient production of steam at the lowest cost.

When you check its other features, when you see its simplicity of design, when you notice its almost silent operation you'll understand why today's Perfect Spread Stoker is a *must* for today's boiler room—and for many years to come.

Get the details! Write for the completely descriptive folder!

Æ

PERFECT SPREAD STOKER



—with stationary grates, dumping grates or continuous ash discharge—up to 400,000 lbs. of steam per hour.

Won't Clog on Wet Coal!

PROVED IN PERFORMANCE FOR 17 YEARS

Today's Perfect Spread Stoker provides significant improvements to a product with a 17 year record of successful performance in 15 industries. Investigate this improved Perfect Spread Stoker.

Other Æ Products: Æ Taylor Stokers, Lo-Hed Hoists, Marine Deck Auxiliaries, Hele-Shaw Fluid Power

AMERICAN ENGINEERING COMPANY

2400 ARAMINGO AVENUE, PHILADELPHIA 25, PENNSYLVANIA

NICHOLSON Cylinder Control VALVES

Set a New High in Slow Wearing

Featuring specially treated extra hard seats that don't cut out and a simplicity of design that minimizes trouble, Nicholson cylinder control valves are setting new records for long wear in many plants. Precision-made throughout to give maximum exactness of control and regulation.

Custom Construction to Meet Your Specific Needs

To meet your specific pressures and mediums, valves are assembled from a choice of six different combinations of metals. Types for air, gas, steam, water, oil and other liquids. Pressures to 500 lbs.

Reference File Valve Catalog 543

W. H. NICHOLSON & CO. 125 OREGON ST. WILKES-BARRE, PA.

Specify MACWHYTE ELEVATOR ROPES to your Elevator Maintenance Man

6 x 19 Macwhyte Traction Steel, PREformed or Non-PREformed

For safety, service, economy, you can't beat Macwhyte Elevator Ropes. They contain extra tough, flexible wire drawn under strict metallurgical control from selected steels in our own mill.

Ask your Elevator Maintenance Man for these ropes which have a minimum of stretch, yet ample flexibility to withstand bending fatigue. He can get them from Macwhyte Distributors and Mill Depots.

MACWHYTE COMPANY

2944 Fourteenth Avenue, Kenosha, Wisconsin

Makers of the correct ropes for your equipment

MACWHYTE COMPANY 50th Year 1896 – 1946

8 x 19 Macwhyte Special Traction Steel, PREformed or Non-PREformed

NO. 869-E

PREformed and Non-PREformed elevator ropes for low-cost-per-car-mile service

Minneapolis; Metal Goods Corp, St. Louis, Tulsa, Dallas and Houston; General Machinery & Supply and American Brass & Copper Co, San Francisco; Metropolitan Supply Co, Los Angeles; and Eagle Metals Co, Seattle.

Gordon S Rentschler and George Murnane have been elected directors of **Corning Glass Works.** Russell Brittingham has been made assistant to W C Decker, vice-president in charge of bulb and tubing and technical products divisions.

Appointment of **W G Winslow** as South American sales representative for their products has been announced by four American manufacturers: He will handle sales of Falk Corp's speed reducers and flexible couplings, the Monitor Controller Co's electric motor controls, Reliance Electric & Engrg Co's motors and generators and Union Chain & Mfg Co's chains and sprockets. From his headquarters in Sao Paulo, Brazil, Mr. Winslow will establish distributors in several industrial centers of principal South American equipment markets.

Reliance Electric & Engrg Co elected Edward E Helm sales vice-president.

T H Daugherty has been named assistant to Everett P Partridge, director of research of **Hall Laboratories** and **Calgon, Inc.**

Dampney Co of America announces appointment of P H Lair as manager of its New York sales office, 114 Liberty St, New York 6, N. Y.

J Robert Kelley has been made executive vice-president of **Manning, Maxwell & Moore, Inc.**

John Hammond has joined **Allied Control Valve Co,** S Norwalk, Conn., as vice-president and general manager.

Allied Control Co, New York, N. Y., elected Lewis A Jones as a vice-president.

Nordberg Mfg Co announces election of F H Kilberry to position of executive vice-president and director, to fill the vacancy created by resignation of C E Stryker.

C E Stryker has accepted the position of president of **Adel Precision Products Corp** of Burbank, Calif.

Optimus Equipment Co names Grover C Schantz as production superintendent.

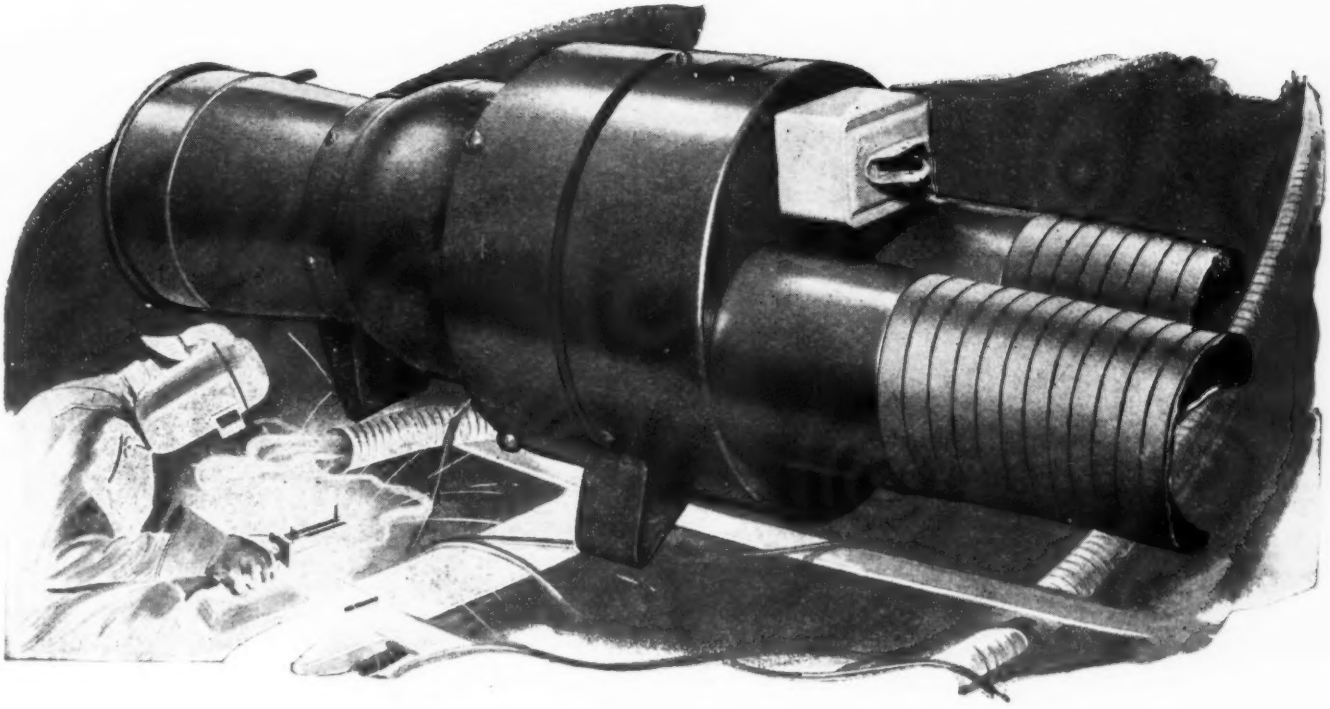
Mathieson Alkali Works appoints Nelson F Wilmot Chicago district sales manager, and Merle S Clark St. Louis district sales manager.

Ernest R Meserve returns to **Graybar Electric Co** as eastern divisional merchandising manager. He will supervise distribution and sale of radios and electrical appliances throughout northern New Jersey, Connecticut and New York State, with the exception of Buffalo and Rochester territory.

William J Weaver was elected president of **Ansonia Electrical Co,** wholly owned sub-

An Extra Lung for A Man

HAVING TROUBLE BREATHING



The amount of work a man can do goes *down* when foul air comes *in* or the heat goes *up*. Are you giving your workers the equipment that will keep them efficient even when working in hot or noxious fumes?

Many concerns regard Coppus Blowers as "production tools" as well as "safety equipment". They help men to do more work and better work.

You can find in the Coppus line the right blower or exhauster for each "bad spot"—or perhaps one type will handle a variety of jobs. In addition to man-cooling and removing fumes from confined places, Coppus Blowers are used for cooling and drying materials and equipment. They are portable . . . efficient . . . built to Coppus "Blue Ribbon" standards of construction and workmanship in order to withstand severe usage.

Check and mail the coupon for specific information. Address Coppus Engineering Corp., 404 Park Ave., Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in SWEET'S CATALOG, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

COPPUS ENGINEERING CORP., 404 PARK AVENUE, WORCESTER 2, MASS.
Please send me information on the Blowers that clear the air for action.

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausters, welding fumes
- ☐ stirring up stagnant air wherever men are working or material is drying.

NAME .....

COMPANY .....

ADDRESS .....

CITY .....

(Write here any special ventilating problem you may have).

IMPORTANT

FOR THE MAN IN CHARGE OF *PRESSURE GAGES*

This is the first technical catalog written on pressure gages. It explains the theory of operation and gives all the technical details of modern gage construction. It tells how the Helicoid movement works—an exclusive feature of Helicoid Pressure Gages. If you use any quantity of pressure gages in your operations, the man in charge of your gages should have a copy of the new Helicoid Gage catalog.

ACCO

HELICOID GAGE DIVISION
AMERICAN CHAIN & CABLE
Bridgeport 2, Connecticut

sidiary of Noma Electric Corp. Following Ansonia appointments were also announced: A P Lunt was elected vice-president. E B Anschutz was made treasurer. Arthur L Corbin became secretary.

James A McPeak and Raymond P Farrell are now associated with **Harper Packing Co,** Chester, Pa., in a managerial and financial capacity.

Portable Products Corp, Pittsburgh, Pa., has appointed new sales managers for Paul and Beekman Metal Stamping Div at Philadelphia and C J Tagliabue Instrument Div at Brooklyn. E R Jacobsen is named sales manager at Paul and Beekman. A G Koenig is named general sales manager of Tagliabue Div where he succeeds E D Wacker, who had been previously appointed general manager of the Tag Div.

Roger W Batchelder has been made general purchasing agent of **American Brake Shoe Co,** replacing William T Kelly Jr, now president of company's Kellogg div.

B-W Superchargers, Inc, has moved to 11610 Euclid Ave, Cleveland, O.

Monsanto Chemical Co announces appointment of Sam R Clement as assistant general branch manager of its Birmingham sales district, which comprises southeastern states and has its headquarters at Birmingham, Ala.

John W Ryzner has been made director of research and Arthur L Jacoby assistant director of research of **National Aluminate Corp,** Chicago.

Raymond Reuter has joined the staff of **Chicago Chemical Co,** which is a subsidiary of National Aluminate Corp, as sales and technical representative.

Star Electric Motor Co announces opening of a New England district office at 1430 Massachusetts Ave, Cambridge 38, Mass. Elliot W Knight has been appointed district manager.

Harbison-Walker Refractories Co made the following men assistant district sales managers. E S Stockslager in New York district; E M Sarraf in Cleveland district; H S Schweinsberg in Philadelphia district; J H Owen in Chicago district.

Crosley Motors, Inc, appointed Kurt Sprengling as commercial sales manager.

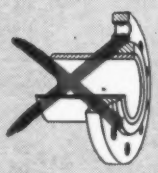
Ideal Commutator Dresser Co changed to a corporation and is now known as **Ideal Industries, Inc.**

Brooks Equipment Corp consolidated its executive and sales offices and production facilities and moved to new headquarters in Hoboken, N. J.

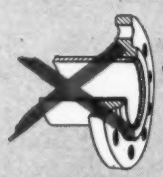
J C Curry has been appointed assistant sales manager of structural products div, **Wickwire Spencer Steel.** Milton-Hale Machinery Co, 438 E Brighton Ave, Syracuse 10, N. Y., has been appointed distributor for Wickwire Spencer wire rope in

WHEN YOU NEED Lap-Joint Stub Ends

LAP-JOINT STUB END



SCREWED AND WELDED FLANGE

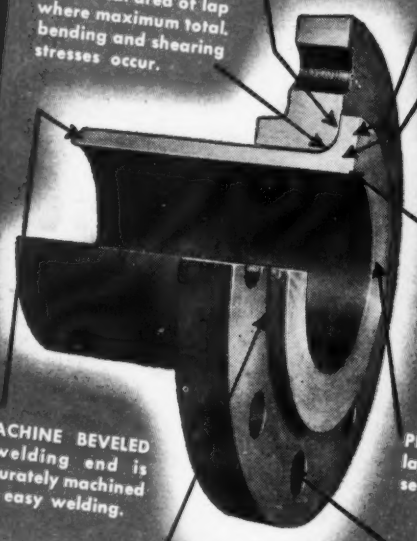


SLIP-ON WELDING FLANGE

WELDING NECK FLANGE

Whenever a flanged joint is required, the lap-joint stub end has a great advantage over flanges welded to the pipe. The swivel flange makes it unnecessary to accurately line up the bolt holes before welding; "setting up" is simple and quick because no special clamps or jigs are required to hold the face of the flange absolutely perpendicular to the axis of the pipe. The result is a real saving in time and cost of welding. Field crews report a saving of 25% in erection time for making up a joint using Midwest Lap-Joint Stub Ends in comparison with flanges rigidly fixed to the pipe.

Specify MIDWEST FOR THESE REASONS



FORGED LAP—by special Midwest process that simultaneously upsets pipe and forms lap. Tests prove superiority of process.

LARGE RADIUS FILLET—More metal, hence greater strength, in the critical area of lap where maximum total bending and shearing stresses occur.

HEAVY LAP—After machining front and back, lap is always at least equal to pipe wall thickness.

STRESS RELIEVED—Metal in lap is worked at forging heat, then normalized to assure uniform, close grained structure. Photo-micrographs frequently show it to be superior to original pipe metal.

SQUARE CORNER—(instead of a round corner) adds to lap strength and eliminates pock-ets for accumulation of con-densate and sediment which promote corrosion.

MACHINE BEVELED—welding end is accurately machined for easy welding.

PHONOGRAPHIC FINISH of lap face to hold gasket more securely.

UNIFORM FLANGE BEARING—Back face of lap carefully machined to assure uniform flange bearing nec-essary to satisfactory joint.

TIME SAVED—In welding and erection because bolt holes need not be carefully lined up before welding.

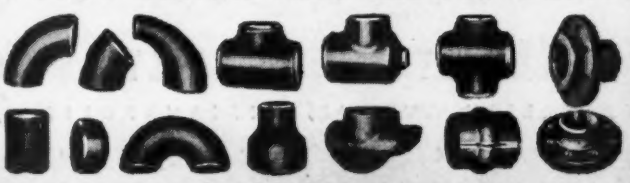
MIDWEST

PIPING & SUPPLY COMPANY, INC.

Main Offices: 1450 South Second St., St. Louis 4, Mo.

Sales Offices: New York 7—(Eastern Division) 30 Church St., Chicago 3—645 Marquette Bldg. • Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg. • Tulsa 3—533 Mayo Bldg. • Atlanta 3—Red Rock Bldg. • South Boston 27—426 First St. • Distributors in Many Cities

MIDWEST WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS

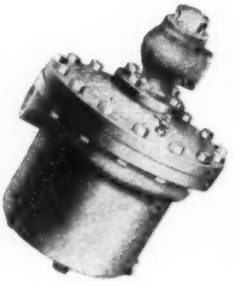


• This No. 110 Stickle Steam Trap weighs only 4½ pounds. It has a capacity of 500 lbs. per hour. Three larger sizes, making four traps in Stickle 100 Series, supply a capacity range up to 3,000 lbs. per hour. Supply exceptionally desirable drainage for unit heaters, laundry equipment, jacketed kettles and other smaller size processing equipment operating at medium and high pressures. No complicated internal mechanism to get out of order—Stickle Open Float design makes both for simplicity in construction and positive operation. Internal strainer keeps dirt particles from reaching valve. Trap bypassed by quarter turn of nut at top. Body removable without taking trap from line. Designed for economical straight-in-line installation. In every way a more efficient steam trap. Ask for Bulletin No. 115.

• Stickle AE Series Traps built for working pressures up to 200 lbs. (450 lbs. if made of steel). Capacities approximately four times old standard traps of comparable size. Seven sizes supply capacity range of 5,000 to 21,000 lbs. an hour. Ask for Bulletin No. 315.

All of these Advantages in Steam Traps for YOUR Operating Conditions

1. **DEPENDABLE SERVICE**—Stickle obviates most "steam trap troubles" with the natural Stickle Open Float Principle, and stark simplicity of construction. Location of valve in top of trap prevents scale and dirt obstruction.
2. **POSITIVE OPERATION**—Filled open float releases valve for trap discharge. Emptied open float regains buoyancy and closes valve. Both actions instantaneous—positive—frictionless. No steam blown at end of discharge—perfect water seal at all times. Air and gases eliminated with each discharge.
3. **FREEDOM FROM REPAIRS**—Absence of hinges, levers, pins—all unnecessary mechanical parts—leaves few things to repair or replace. Chromium valve and seat, always in perfect fit through constant regrind action of trap in operation, never stick.
4. **MAXIMUM CAPACITY WITH MINIMUM SIZE** — Large capacity of Stickle Traps in ratio to size affords installation convenience as well as installation economy. Each series, or design, of Stickle Traps built to meet specific conditions and give best results and most efficient performance under operating requirements.



• Stickle Series 50 Pop Valve Traps built especially to meet the special drainage requirements of evaporating, cooking and other processing equipment operating at high pressures, creating large volumes of condensate. Ask for Bulletin No. 515.
• Stickles Series T Traps for low pressure and for vacuum service described in Bulletin No. 415.

OTHER STICKLE EQUIPMENT

Stickle Differential Drainage and Boiler Return System—a closed pumping system that returns condensate under pressure from processing units to boilers at temperature only slightly lower than that at which it leaves traps. Bulletin No. 250.

Stickle Regulating and Reducing Valves—two series in standard types designed and constructed for industries requiring dependable and accurate control within extremely close limits of variation. Bulletins Nos. 235 and 435.

Stickle Open Coil Feed Water Heaters—small to large capacities, deaerating and non-deaerating types, cast iron or steel construction. Bulletin No. 117.

STICKLE STEAM SPECIALTIES COMPANY

2265 VALLEY AVENUE, INDIANAPOLIS 1, INDIANA

SPECIALIZING FOR MORE THAN 40 YEARS IN REDUCING THE COST OF STEAM

Syracuse and Albany, N. Y. Armor Fence Co. 191 N Beacon St, Boston-Brighton 35, Mass., has been made distributor for Wickwire Spencer chain-link fence.

General offices of **National Electric Products Corp** moved to 411 7th Ave, Pittsburgh 19, Pa.

Wagner Electric Corp announces branch manager and sales territory changes in its electrical sales div: The Kansas City territory has been divided into parts: Southern portion, comprising Tex., Okla, and parts of N. M., Ark. and La., is now the Houston branch office territory, with sub-offices at Dallas and Tulsa, with L J Dicianne as branch manager. Northern portion continues to be known as Kansas City branch office territory and is now limited to Kansas and Nebraska and western halves of Iowa and Missouri, with A. G. Viola as branch manager. J L Pasher is now in charge of electrical and automotive divisions in Pittsburgh.

W J Herrman has joined **Commonwealth & Southern Corp,** New York, as rate analyst.

Southeastern Indiana Power Co has appointed P Waldo Ross vice-president and general manager.

Frank N Williams rejoins **Associated Engineers, Inc,** as account executive. He will be a permanent member of the management engineering policy board and will supervise several current assignments. Fred L Tanner joins company as technical consultant. Mr. Tanner will travel out of the firm's offices in Fort Wayne, Ind., specializing in all phases of electrical engineering, power-plant engineering and plant layouts. He will also work with public utility companies and make property and equipment appraisals.

Harry F Lowe, for some time head of Materials Control Branch of Office of War Utilities, has been made a partner in the firm of Sloan and Cook, Chicago utility engineers and consultants. The firm, with offices at 120 S LaSalle St, Chicago, will be known as **Sloan, Cook and Lowe.**

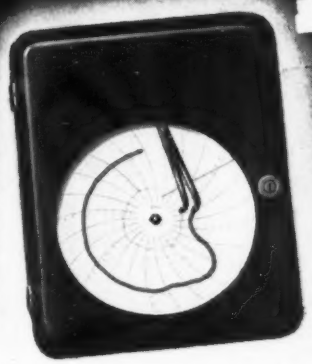
Six more veterans have been added to staff of **Arthur D Little, Inc:** William A Merdinyan, mechanical engineer; William G Neall, chemical engineer; Ernest R Poor, civil engineer; Carl G Erikson, chemical engineer; Daniel J Leone, clerk; and Alfred E Forgette, maintenance.

F E Hunt and S A Hadley announce formation of **H & H Engrg Service,** 215 W Pershing Rd, Kansas City 8, Mo., specializing in installation, testing and servicing of mechanical power-plant equipment, visual or breakdown inspections and analysis, etc.

A J P Wilson has joined the New York City office of **McKinsey & Co,** management consultants.

Following were appointed to faculty of **Technological Institute of Northwestern University:** George G Lamb was made professor of chemical engineering. Miklos

Prevent Runaway Losses



Specify LADISH Forged Steel Fittings

Insure economy in piping installations through the use of Ladish Controlled Quality Forged Steel Fittings. Sharp, clean cut threads machined to exacting tolerances, together with the added strength and endurance afforded by *Controlled Quality* Ladish Forged Steel Fittings assure years of trouble-free, efficient operation and freedom from costly fittings failures.

Machined from drop forgings—Ladish Controlled Quality Fittings give you the ultimate in satisfaction, economy and dependability.

Write for your copy of Ladish Forged Steel Fittings Catalog Volume 2.

- RESISTANCE TO STRAINS of expansion and contraction over wide temperature ranges is measurably improved with the tougher, more compact grain structure provided by Drop Forging.
- RESISTANCE TO FATIGUE is accomplished by accurately controlled grain flow for maximum strength at vital points provided by Drop Forging.
- RESISTANCE TO SHOCK PRESSURES is materially improved by increased dynamic strength and toughness of metal produced by Drop Forging.
- FREEDOM FROM INTERNAL DEFECTS is assured by the denser, more homogeneous metal structure of Drop Forgings.

UNIFORM WELDABILITY . . . FREEDOM FROM LEAKS . . . LONGER LIFE

Controlled Quality

FITTINGS DIVISION

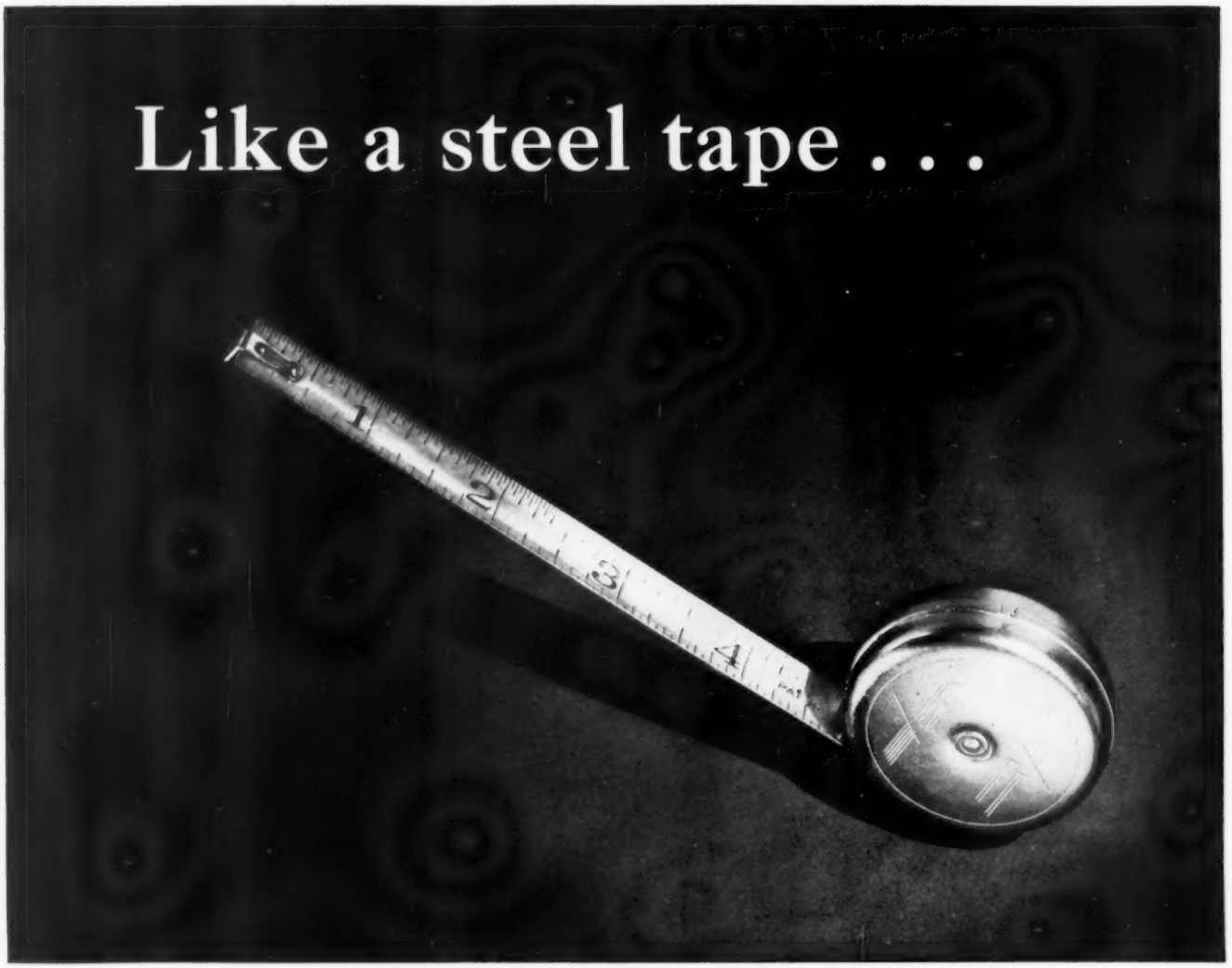
LADISH DROP FORGE CO.

CUDAHY • WISCONSIN (MILWAUKEE SUBURB)

District Offices: NEW YORK • PITTSBURGH • CLEVELAND • ST. LOUIS • HOUSTON • LOS ANGELES

TO MARK PROGRESS

Like a steel tape . . .



The Royal never needs adjustment

Because there's nothing to adjust

The *only* Flush Valve which eliminates regulation or adjustment is the ROYAL. Its simplicity of engineering design, *plus* precision manufacture, insure accurate and lasting performance.

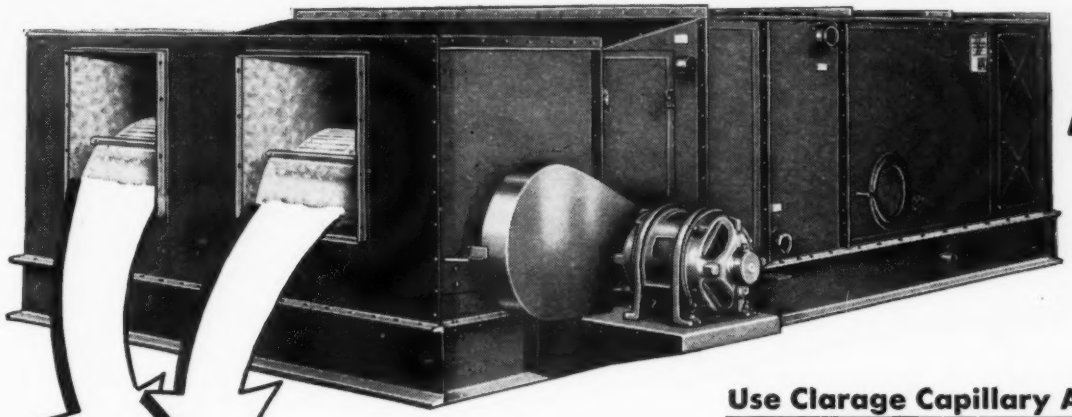
More than 4 million ROYAL Flush Valves are in daily service—including thousands of the first ROYALS installed over 36 years ago.

The ROYAL is "standard equipment" with discriminating builders and owners throughout the country. In fact, entire school systems, hotel chains, hospitals, industrial institutions, etc., use ROYALS exclusively.

For the best in Flush Valves specify Sloan—remember, there are more Sloan Flush Valves sold than all other makes combined.

SLOAN VALVE COMPANY
4300 WEST LAKE STREET, CHICAGO 24, ILLINOIS

WHEN YOUR PLANT AIR GOES IN HERE



Illustrated is a No. 34H3 Capillary Unit Conditioner with cooling and heating coils, providing complete air conditioning in one assembly.

It Comes Out Here

CLEAN and COOLED
HUMIDIFIED or DEHUMIDIFIED

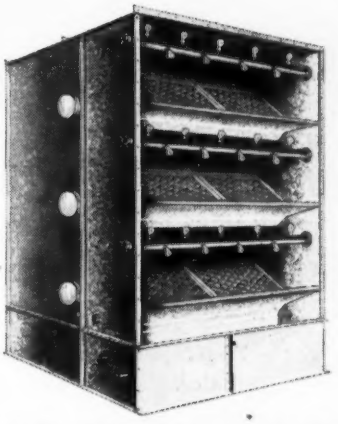
Use Clarage Capillary Air Conditioning Units where Accurate Control of Temperature and Humidity is Important — and where Maximum Air Cleanliness is Vital to Production, Uniform Quality of Product, Health or Safety.

Clarage Capillary Air Conditioners are complete factory assembled units, including a Capillary cleaning section, pump, heating coils, fan, drive and motor. They are available in seven sizes — 1800 to 20,000 c.f.m. Horizontal units, as shown above, are built in both Class I (con-current) and Class II (counter-current) types. Vertical units in Class II arrangement only.

There are excellent reasons for considering this modern air conditioning equipment: (1) Inexpensive to install — no costly building alterations required; (2) Everything in one "package" — no parts to assemble on the job; (3) Proper coordination and performance of all parts assured by factory tests; (4) Low first cost and low operating costs—the result of shrewd, advanced engineering.

★ ★ ★

Write for our Bulletin 122. It gives complete information.

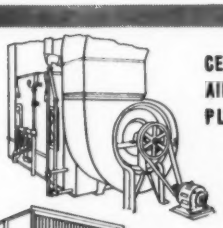


CAPILLARY AIR WASHERS

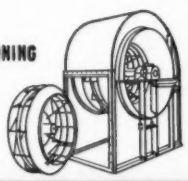
are available in a series of five height sizes, and in eleven widths — capacities from 4,400 to 132,000 c.f.m. They are built in Class I (con-current), Class II (counter-current) and Class III (con-current with coils) types. Bulletin 120 describes complete line of equipment.

SOME OF OUR OTHER PRODUCTS

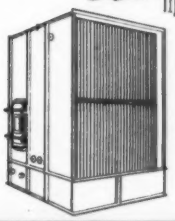
UNIT HEATERS



CENTRAL STATION AIR CONDITIONING PLANTS



AIR CONDITIONING AND VENTILATING FANS



AIR WASHERS

CLARAGE
FAN COMPANY
Kalamazoo, Michigan

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

WHO'D EVER EXPECT AN ENGINEER TO BLUSH?

And yet he might, if his full worth were realized in the "front-office" . . . and someone patted him on the back for it.

But busy management is overwhelmed today with production, sales and labor problems. It can't be expected to keep up with *all* the things you have to know; nor to know about your troubles in coaxing along outmoded equipment. In short, your value, in relation to product-costs and profits, may not be fully realized.

Aware of how important it is for management to "measure up" its engineer, and because engineers aren't inclined to boast about themselves and their work, PREFERRED is sponsoring a valuable free-for-the-asking booklet which tells the engineers' story for you. Titled, "Dividends From Your Power Plant," it is probably the first clean-cut statement to management on what the engineer understands and does.

The ten factual articles contained in the book's 36 pages, are written in simple, easily understood terms. Busy executives will quickly grasp them. (No, there is no advertising—no selling matter, whatever).

Read first, "The Engineer is a Gold Mine." Then, after you've gone from cover to cover, earmark the book for the Boss' desk. Its practical approach to power-plant problems will prove no less interesting to him than to you. Here are a few quotes to acquaint you with the book's contents: "Good Boilers Can Waste Money"; "If Steam Were A Raw Material"; "Stack or Fan for Draft."

To get your copy before the present printing is exhausted, clip and mail the coupon today! It will prove well worth your while.

PREFERRED Utilities Manufacturing Corporation
1860 Broadway, New York 23, N. Y
Manufacturers of the "Unit Steam Generator"

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Clip and mail today

PREFERRED UTILITIES MFG. CORP.
1860 BROADWAY NEW YORK 23, NEW YORK

Please send me FREE and without obligation, bulletin #1000 and the ten articles in booklet form, titled—"Dividends From Your Power Plant".

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PR-112

P-4-46

PREFERRED UTILITIES

PREFERRED UTILITIES Rigged for Results ENGINEERS

Hetenyi became professor of theoretical and applied mechanics. George Sommerman and Alexander Wing Jr were made associate professors of electrical engineering. Robert R Buss and John Lyon became assistant professors of electrical engineering.

C B Osborne, just out of the Navy, has returned to his position as sales manager of **Electric Power Board** of Chattanooga.

Lutz-Johns Co has been appointed agent by **S P Kinney Engineers, Inc**, to handle the Brassert automatic self-cleaning water strainer in Chicago district.

National Association of Vertical Turbine Pump Manufacturers elected Arnold G Brown, manager of pump div, Fairbanks, Morse & Co, Chicago, Ill, as its president and Joe Downs of A D Cook, Inc, of Lawrenceburg, Ind., as vice-president.

Industrial Unit Heater Association elected R Resch president, F P Kohlbry, vice-president and L O Monroe, secretary-treasurer. Mr. Resch is president of McQuay, Inc, Minneapolis. Mr Kohlbry is president of Airtherm Mfg Co, St. Louis.

Propeller Fan Manufacturers Association elected M L Aitken president, H M Guilbert vice-president and L O Monroe acting secretary. Mr Aitken is manager of Propellair, Inc, Springfield, O., and Mr. Guilbert is manager of propeller fan div of B F Sturtevant Co, Boston, Mass.

OBITUARIES

John A Kershaw, 74, once in charge of the copy service dept of the old Hill Publishing Co, then publishers of POWER, and recently eastern manager of Technical Publishing Co, publishers of Power Plant Engineering, died at his home in New Rochelle, N. Y., on Jan 16. In his long career, Mr. Kershaw made many important contributions to industrial publishing and advertising. His death is a great loss to his friends and associates.

Leonard H Davis, 73, consulting engineer of Union Carbide and Carbon Corp, died Feb 19 at his home in New York City.

Herman A Everlien, general sales manager of mechanical goods div of U. S. Rubber Co, died Feb 21 at his home in New York.

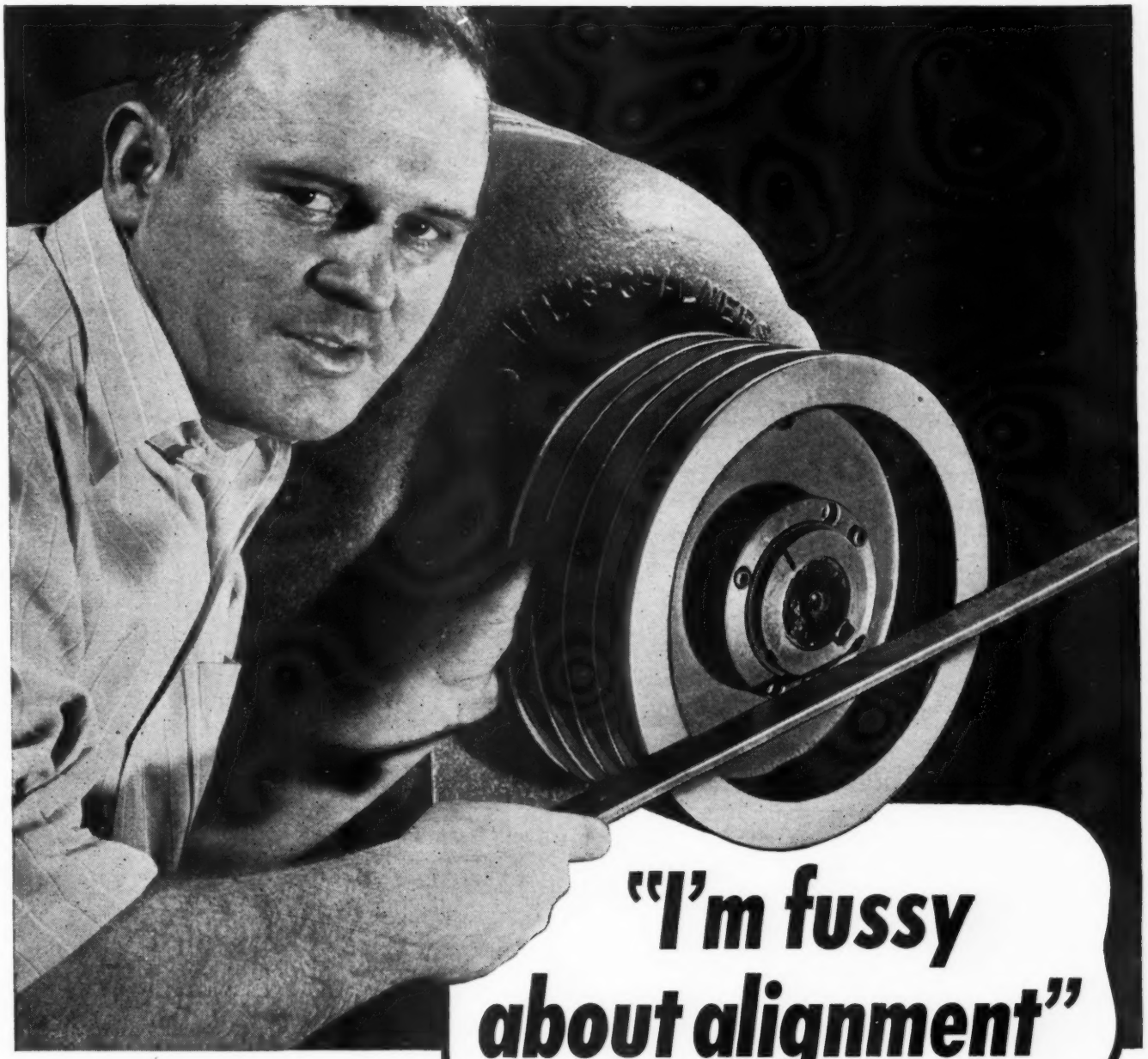
John Jacob Brown, 73, chairman of boards of Foster Wheeler Corp, New York, and Foster Wheeler Ltd, St. Catherine, Ont., died in St. Lukes Hospital, New York, on Feb 15 after a brief illness.

James Donovan, 45, for past 18 years an operating engineer at Boston College, lost his life in an accident in that institution on Feb 27.

Frank R Zumbro, 56, chief engineer of ice and refrigerating machinery dept of Frick Co, Waynesboro, Pa., died suddenly of coronary occlusion at his home on Feb 17.

John L Rice, 68, stationary engineer of Niagara Falls, Ont., was killed recently when struck by a train on a crossing near Niagara Falls, Ont.

J Howard Courtner, 40, assistant general manager of Dowell Inc, at Tulsa, Okla., died Feb 22 in a Chicago hospital.



"I'm fussy about alignment"

TEXROPE "MAGIC-GRIP" SHEAVES make the job easy!

JUST slide it on the shaft — move it into exact alignment, using a straightedge if desired — then tighten three cap screws. It's easy as that.

Sheave and bushing come completely assembled. No hammering, no filing or reaming. The patented "Magic-Grip" Sheave gives a powerful clamp fit without backlash, shear or wobble. Yet it can be taken off as easily as it goes on.

You save manhours and money the first time you mount a Texrope "Magic-Grip" sheave — and every time after. In addition, there are no set screws to score shaft. And because you don't *hammer* it on, you can't damage motor bearings!

These advantages cost you nothing extra. For details call your A-C office or dealer, or write for Bulletin B6310. ALLIS-CHALMERS, MILWAUKEE.

V-BELTS

TEXROPE complete line — Sizes, types for every power transmission problem and condition.

ALLIS CHALMERS

TEXROPE V-BELT DRIVES

ORIGINATORS OF THE MULTIPLE V-BELT DRIVE

SHEAVES

"MAGIC-GRIP" . . . TEX-STEEL . . . TEXDRIVE . . . Speed changers and VARI-PITCH sheaves.

HEAR THE BOSTON SYMPHONY: *Every Saturday Evening, American Broadcasting Co.*

A 2008

DO YOU handle any of these materials in bulk?

ASHES
COAL
COKE
GRAVEL
ORE
SAND
STONE

• Beaumont Skip Hoists are ideal for high lifts and for handling heavy, abrasive and bulky materials. One or two buckets operating in heavy I-beam tracks, either counterweighted, un-counterweighted or balanced. Automatic and semi-automatic operation. All capacities and sizes. Write outlining your requirements for our engineer's recommendations and quotation.

Heavy I-beam Tracks

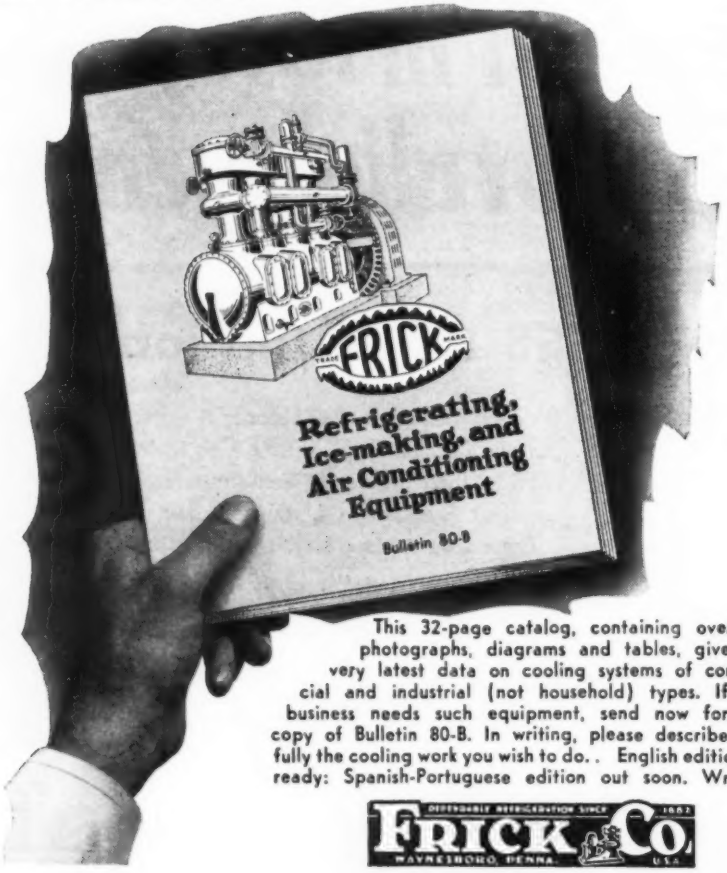
In the installation illustrated, the skip hoist handles both coal and ashes alternately, in same bucket, and discharges to either coal or ash bunkers.

BEAUMONT BIRCH COMPANY

1502 RACE STREET PHILADELPHIA 2, PA.

DESIGNERS • MANUFACTURERS • ERECTORS OF COAL AND ASH HANDLING SYSTEMS

Get this informative book—



This 32-page catalog, containing over 150 photographs, diagrams and tables, gives the very latest data on cooling systems of commercial and industrial (not household) types. If your business needs such equipment, send now for your copy of Bulletin 80-B. In writing, please describe carefully the cooling work you wish to do. . English edition now ready: Spanish-Portuguese edition out soon. Write to

FRICK CO.
WAYNESBORO, PENNA. U.S.A.

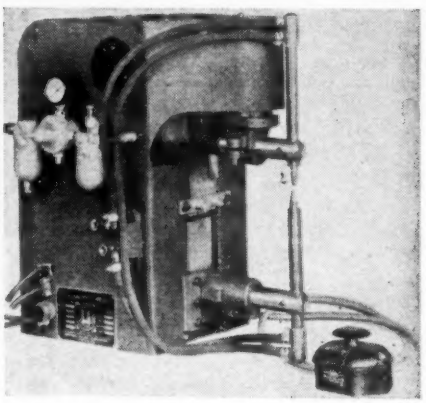
New Equipment

(*Continued from page* 128)

dry construction. Regulator, small in size, has no moving parts and may be installed in almost any desired location. It requires no discharge coils or other safety devices. **Modern Control Equipment Co, 176 W Adams St, Chicago 3, Ill.**

Drill Bit

CYCLONE DRILL BIT drills holes in concrete, cement, brick, tile, marble and other forms of masonry. This drill features a carbide tip. Drill is used in an ordinary rotary electric drill and therefore eliminates hammering. Machine shops also employ this device for drilling chilled iron and for cored holes in aluminum, cast iron and other nonferrous materials. Cyclone drill is made in stock sizes starting at $\frac{3}{16}$ in. up to, and including, 1½ in. dia, by steps of $\frac{1}{16}$ in. **New England Carbide Tool Co, 60 Brookline St, Cambridge, Mass.**



Spot Welder

ADDED TO UNIVERSAL LINE of 1-kva and 3-kva air-operated bench spot-welders is USP-7½. Like USP-1 and USP-3, it is a plug-in model and includes solenoid-valve control of air cylinder and pressure switch. It may be furnished with built-in NEMA 1A electronic timer. It may also be had with NEMA 3B or 5B in separate-timer panel.

The solenoid-valve control of air cylinder by adjustable pressure switch provides a wide range of applications for welding nonferrous metals, wire, etc. It welds two pieces of 16-gage steel. The 7½-kva unit is equipped with air filter, pressure gage and automatic lubricator. Initiation of welding cycle is by electric foot switch. It is equipped with watercooled transformer and electrodes. **Davis & Murphy, 5252 Broadway, Chicago 40, Ill.**

Positioner and Indicator

CONSISTING OF RECEIVERS and transmitters, dc positioning and indicating equipment operates from any ac or dc line. Applications include governor and generator field-control systems for multiple synchronized diesel-electric drives, master remote control for

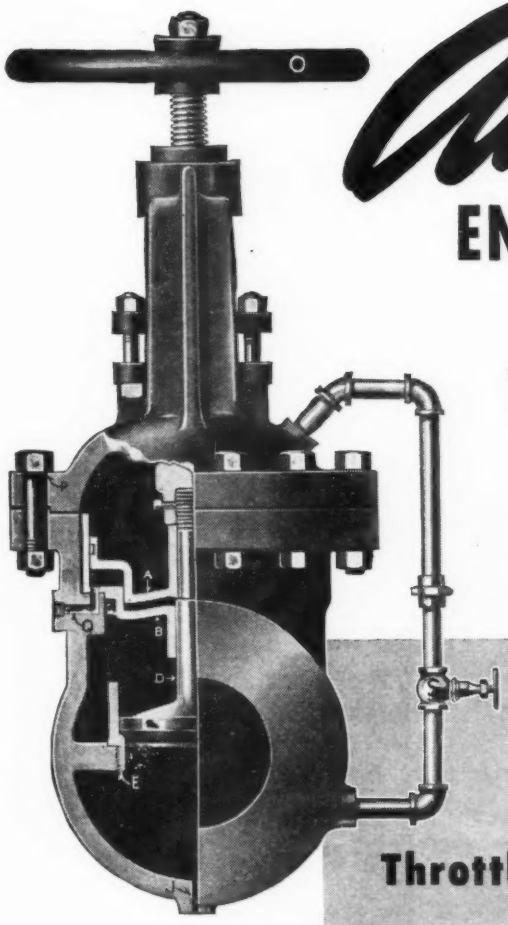
Automatic

ENGINEERED PROTECTION

against

TURBINE OR ENGINE

Overspeeding

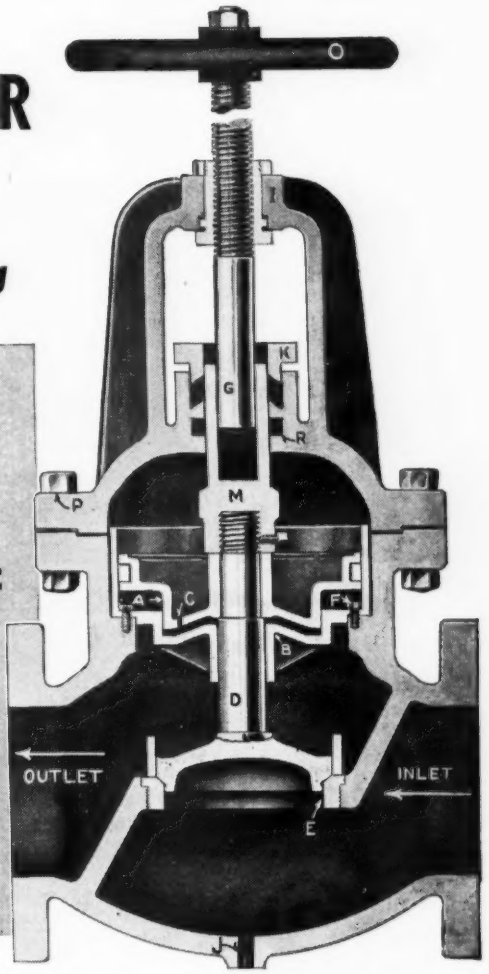


GOLDEN-ANDERSON

Throttle and Automatic

ENGINE STOP

VALVES



HERE is how it operates: With the by-pass valve opened, and the trip pilot control valve reset in its closed position, whenever handwheel stem is run up, the valve will automatically open to admit pressure into engine or turbine. On overspeeding of engine or turbine, the shaft governor may directly operate trip pilot control valve or limit switch, if solenoid trip pilot control is used, to open trip control valve, and permit engine stop valve to instantly close and stop engine or turbine. Remote control can be installed anywhere in the station and still permit manual closing of the valve at any time. Catalog on request.

Other ***GOLDEN ANDERSON***

AUTOMATIC VALVES

- **Non-Return Valves**
- **Throttle and Automatic Engine Stop Valves**
- **Emergency Trip Valves**
- **Pressure Reducing Valves**
- **Altitude Control Valves**
- **Float Operated Control Valves**
- **Check Valves**
- **and many other types for safe, dependable flow control.**

GA

GOLDEN-ANDERSON

VALVE Specialty Company

FULTON BUILDING • PITTSBURGH 22, PA.

ARMOR-CLAD

(MONOLITHIC COATING)

REFRACTORY PROTECTION

saves 4 ways!

3 minutes torch test leaves ARMOR-CLAD coating and brick undamaged — melts untreated brick in 15 seconds.

1. Adds 50% to 200% to wall life
2. Decreases maintenance
3. Eliminates costly shutdowns
4. Easily and simply applied.

Crucial tests prove the ability of ARMOR-CLAD to lengthen furnace-lining life 50% to 200% under actual service conditions. Full, long-lasting protection is assured in temperatures from 1500° to highest furnace temperatures, with absolute freedom from spalling, slag adhesion or penetration of flame, gas or slag. Simple to apply by brushing or spraying — ARMOR-CLAD forms an impervious, resilient, vitreous coating completely sealing joints, pores and cracks in refractory linings, and is applicable to new or used furnaces.

ARMOR-CLAD prevents refractory lining deterioration in large plants throughout the country, ships and transports of the U. S. Navy. Write for literature.

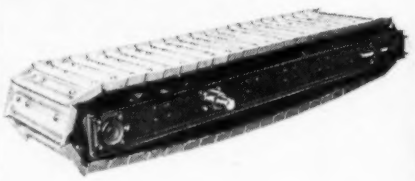
ARMOR-CLAD COMPANY

Refractory Protection

39 HYATT AVE., NEWARK 5, N. J.

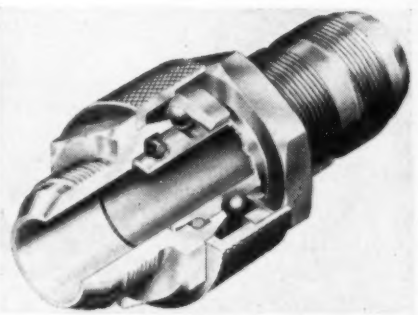
reversing mill motors, remote Ward-Leonard control systems for multiple diesel-electric mobile units and remote indication or control over mechanical, electrical or hydraulic devices such as level, pressure and flow indicators.

Mechanically simple in construction, only four leads are needed for each receiver and two power-supply leads to the transmitter on most applications. All devices are designed with overlapping characteristics to afford maximum interchangeability. Equipment may be readily modified to operate at any desired dc voltage. Six sizes now range from 5 in. oz to 360 in. lb approximate pullout torque and with a small drip rectifier unit may be operated on ac. **Allis-Chalmers Mfg Co, Milwaukee, Wis.**



Apron-Conveyor Unit

HEAVY-DUTY ROLLER-SUPPORTED apron feeder is furnished in several widths and with centers ranging from a minimum of 4 ft, 7 in. to a maximum of 9 ft, 1 in. varied by 18-in. increments. This feeder, widely used under bins and hoppers for heavy lump material, has large capacity. At a normal speed of 10 ft per min, handling 100-lb material, capacity runs up to 80 tons per hr. The heavy-steel chain belt rides directly on large-diameter traction rollers. **Chain Belt Co, 1600 W Bruce St, Milwaukee 4, Wis.**



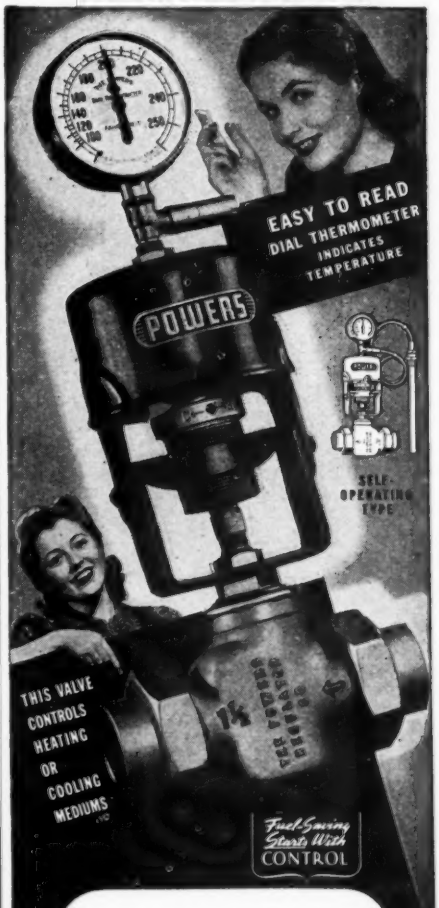
Coupling

BASED ON "inclined plane and wheel principle," the Roylyn *Quick* coupling for hose and lines operating under pressure employs but three major parts: cam ring, ball cage and nipple. By rotating cam collar, steel balls are forced inward into a groove in nipple forcing the halves together. Gasket retained in ball cage provides a positive seal against dirt as well as being the separating spring force necessary to lock operation. A slight shoulder on the cam assures a positive lock; application of more pressure tightens it and only the cam collar can unlock it.

Tests on the alloy-steel model show a temperature operating range from —650 F to +300 F with safe pressure limits of 1680 psi for 2-in. coupling and 11,500 psi for

Economize WITH POWERS

TEMPERATURE REGULATORS



Use a Powers No. 11 Temperature Indicating Regulator when you want the advantages of an easy-to-read dial thermometer combined with a dependable self-operating regulator. The dial thermometer gives a visual check on the performance of the regulator and makes it easy to adjust for the required operating temperature. Various dials and ranges are available.

Is Easy To Install—because both the thermometer and the regulator operate from the same thermal system—only one tapped opening is required.

Write for Circular 2511

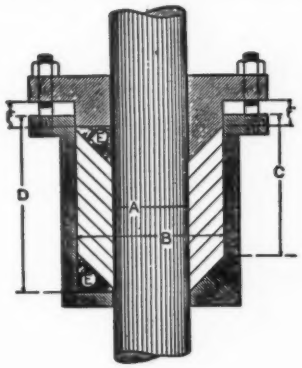
THE POWERS REGULATOR CO.

2717 Greenview Avenue, Chicago 14, Illinois
231 E. 46th St., New York 17, N. Y.—Offices In 47 Cities . . . See your phone directory.

70

OVER 50 YEARS

OF AUTOMATIC TEMPERATURE AND HUMIDITY CONTROL



Q-P Self-Setting PACKING

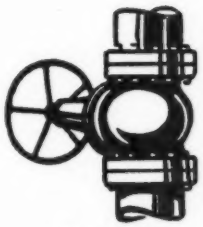
PERFORMANCE-PROVED UNDER UNUSUAL OPERATING CONDITIONS . . . . . .

Q-P Self-Setting Packing has demonstrated its superiority under the most difficult conditions on land and sea and can be depended on to meet post war requirements for high maintenance economy. It is the ideal packing for superheated steam, saturated steam, hot and cold water, ammonia, fuel oil, compressed air, gases and acids and other operating conditions.

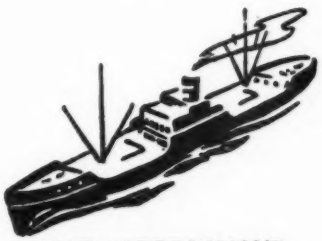
Q-P Self-Setting Packing is moulded to the exact diameter of the rod and stuffing box from various materials depending on the conditions involved. The smaller diameter of the ring or cone, always points toward the condition being sealed. Under pressure the lips of the packing are closed automatically against the rod and the side of the stuffing box with minimum friction, assuring a perfect seal without causing excessive friction or undue wear of rod or packing. Removal of pressure frees the packing from the rod.

Q-P Self-Setting Packing is made in solid and split types to specified rod and stuffing box dimensions. Its proper installation assures longer packing life, infrequent tightening up of gland, and elimination of rod scoring. Outstanding savings in maintenance are a matter of record wherever *Q-P Self-Setting Packings* have been usd.

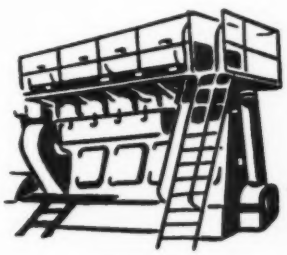
WRITE TO US AND OUTLINE THE SERVICE TO BE PACKED AND WE WILL SUPPLY THE PROPER PACKING



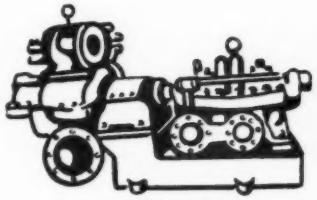
VALVES



TELEMOTORS-VALVE

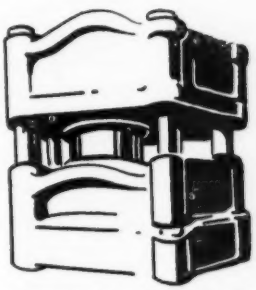


DIESELS

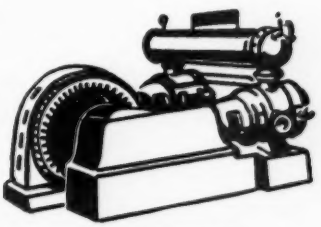


TURBINES

EXPANSION JOINTS



HYDRAULIC EQUIPMENT



COMPRESSOR
(Ammonia)

Sales Representatives

Belmont Supply Co., Waltham 54, Mass.
Chapman Industrial Supply Co., Los Angeles 1, Calif.
Darling Bros., Ltd., Montreal, Canada.
A. G. Day, South Braintree 85, Mass.
Hercules Eqpt. & Rubber Co.—San Francisco, Calif.
Industrial Equipment Co., Charleston 23, West Va.
Kellogg Appliance Co., Philadelphia 44, Pa.
Kindred Appliance Co., Inc., New York 7, N. Y.
Marine & Industrial Supply Co., Seattle 4, Wash.
Meyer Ekstrom Co., Chicago 6, Ill.
Ellis W. Morse Co., Binghamton, N. Y.
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Paramount Packing Co., Baltimore, Md.
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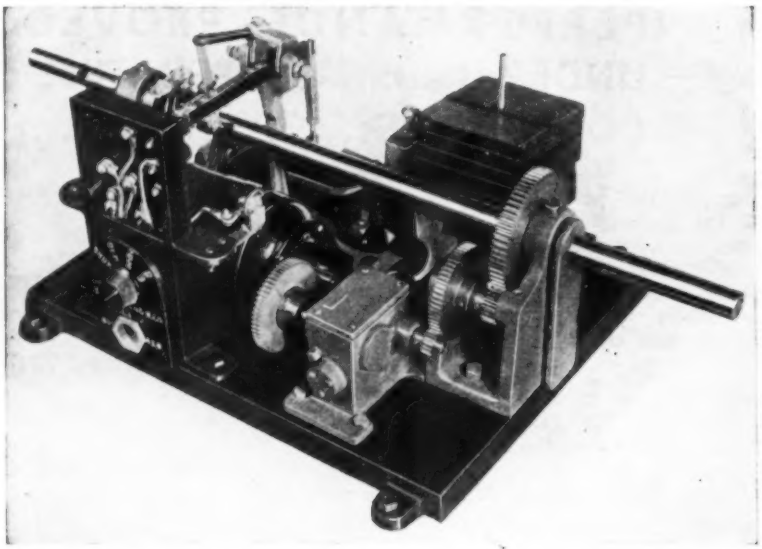
Tutein Equipment Company — Pittsburgh 5, Pa.
Uhrich Supply Co., No. Kansas City 16, Missouri

The
Q-P MANUFACTURING COMPANY
NEEDHAM HEIGHTS, MASS.

BROOKE

PRESSURE REGULATORS

For Regulating Steam, Air or Water Pressures From 1 lb to 1500 lbs!



Here's a *dependable* way to regulate steam, air or water pressures from 1 to 1500 pounds! Brooke Pressure Regulators are electrically actuated from the nearest lighting circuit (no water or compressed air required) and provide sensitive, accurate control. And—they are fully compensated to prevent hunting!

Each unit is self-contained with hand control switch on front of the regulator, also with remote hand control switch if desired. A heavy diaphragm is balanced to close electric contacts upon very slight changes in pressure.

Other construction-feature advantages: (1) Normal life of tungsten contacts is two to three years. (2) Fractional HP reversible motor driving through a train of gears provides up to 200 ft. lbs. torque to operate dampers or valves by rigid link connection.

All Brooke Regulators are fully compensated. For complete information, write today for bulletin.

BROOKE ENGINEERING CO., INC.

4517 Wayne Avenue · Philadelphia, Pa.

MANUFACTURERS OF THE FIRST SUCCESSFUL ELECTRIC EYE SYSTEM OF COMBUSTION CONTROL

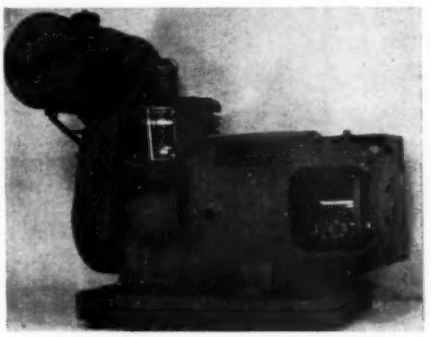
¼-in. unit. Couplings are available in aluminum, brass, alloy or stainless steel with correct gaskets to withstand fuels, oils and acids. Pipe threads or flared tube connections are optional with caps to fit all sizes of nipples. Standard thread sizes run from ¼ to 2 in. **Roylyn Mechanical Laboratory, 8928 Santa Monica Blvd, Los Angeles 45, Calif.**

Maintenance Paint

PEN-KOTE 500 is a chemical-resistant maintenance paint. Applying this quick-drying, odorless protective coating to heated, wet and porous surfaces of all kinds provides protection against hot acids, alkalis, water, etc. **Peninsular Chemical Products Co, 6795 E 9 Mile Rd, Van Dyke, Mich.**

Engine Generator Set

NEW MODEL battery-charging engine generator set uses the Briggs and Stratton NP engine having 2-in. bore, 2-in. stroke, 1-gal fuel tank, float fed carburetor, gravity-feed sensitive flyball governor, which permits adjusting charging rate. Generator is bolted to side of engine crankcase. Drive end of armature is piloted on to engine crankshaft. Grease-



sealed ball bearing carries outer end of armature.

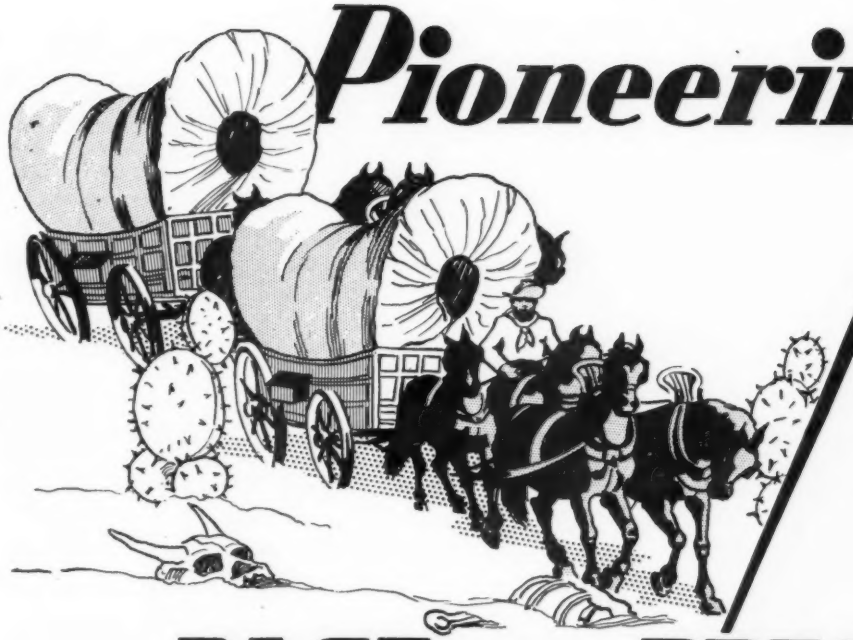
On 6 v this charger charges a maximum of about 80 amp. Length of commutator permits extra-large dual brushes. There are four sets of brushes with two all-brass brush holders on each stud. Extra-heavy conductors and large terminals permit handling large volume of current with low-voltage drop. Each set is provided with starting switch, ammeter and reverse-current relay. Commutator and brushes are easily accessible by removing spun-metal covering. Charger is also available for 12 and 32 v. The plant is self-cranking. Engine, which can be cranked by hand if batteries are too low, has magneto ignition. **Kato Engrg Co, Mankato, Minn.**

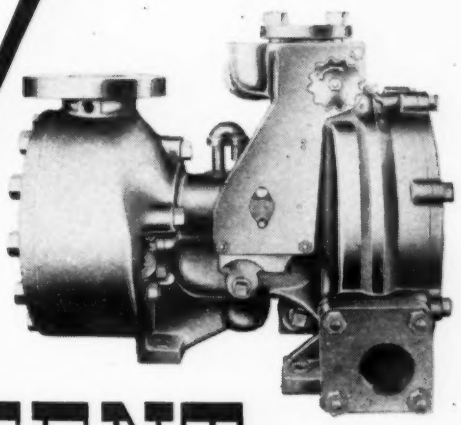
Shielded-Arc Electrodes

ABRASOWELD AC is a hard-facing shielded-arc electrode for building up straight-carbon steel, low-alloy steel or high manganese steel with a self-hardening deposit to resist severe abrasion, battering and impact. Although specially designed for operation on ac, it may serve for industrial and mass-market welding machines and dc. The weld metal maintains its toughness and develops its maximum hardness only at the surface where

(*Continued on page* 196)

Pioneering





PAST AND PRESENT

THE same courage that refused to accept conventional boundaries in the past pioneered the Coffin Turbo Pump.

Over twenty years ago the Coffin Pump crossed conventional speed boundaries and aimed at a definite goal of compactness, light weight and economy.

Through patented engineering design and high speed operation it performs in a single stage, work that formerly required pumps many times its size and weight.

The thousands of installations made to date have proven that there are no boundaries for engineering skill plus the pioneering spirit.

Today the Coffin Turbo Pump is the talk of the Industry.

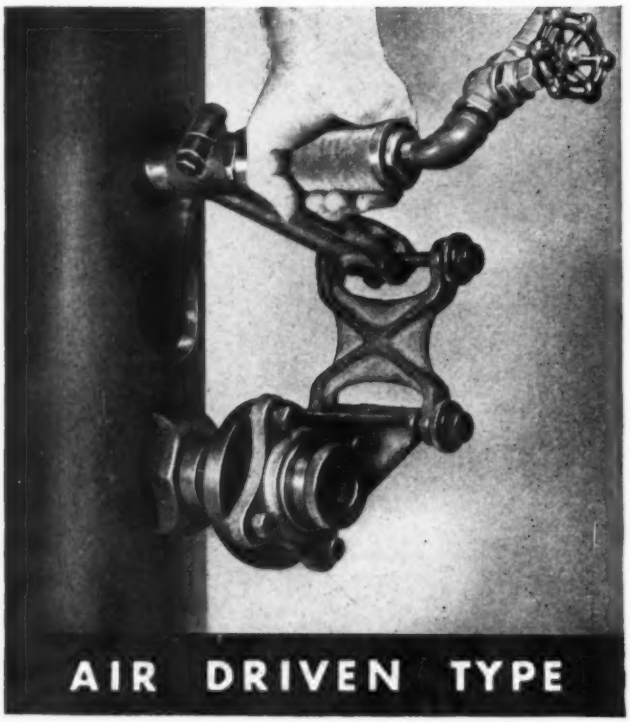
THE J. S. COFFIN, JR., COMPANY

326 SOUTH DEAN STREET
ENGLEWOOD, NEW JERSEY

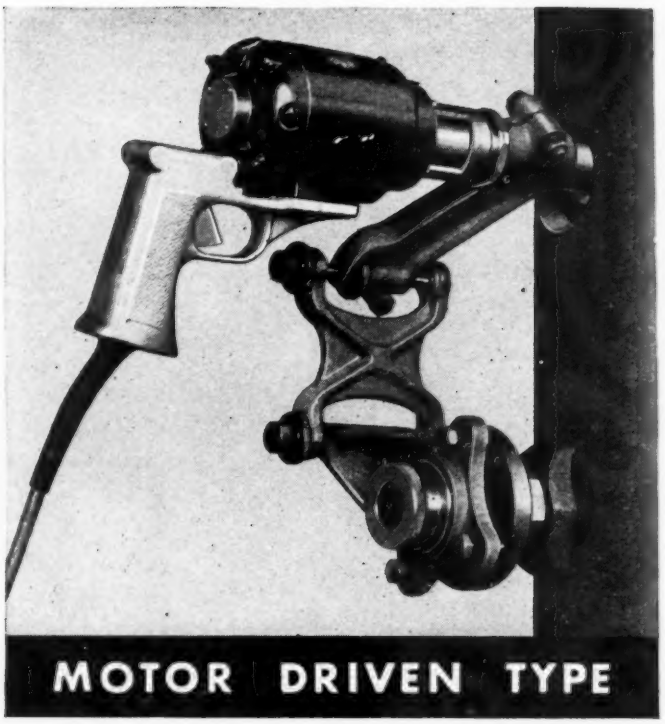
Mail the Coupon

Please Send Descriptive Bulletin I-22

NAME .....
COMPANY .....
ADDRESS .....
P. W.



AIR DRIVEN TYPE



MOTOR DRIVEN TYPE

NOW - a fast accurate way to reface HANDHOLE SEATS!

THE NEW ELLIOTT HANDHOLE SEAT GRINDER replaces the old unsatisfactory hand filing and hand-held motor driven grinding methods of refacing handhole seats in boilers, economizers, superheaters or other pressure units. Time saved and precision gained by this new maintenance tool make it a "must" for every boiler room.

Operation of the Elliott Grinder is simple. The unit is easily clamped to a header and the grinding wheel inserted into the handhole. Air or electric power drives the accurately aligned spindle, motion of which is limited to one plane only—and the whole job is completed in a short time. The refaced seat is left smooth and true—to a degree virtually impossible by old hand filing methods.

An added feature of this new Elliott tool is a wire brush, interchangeable with the grinding wheel, which is supplied for cleaning seats which do not require refacing or for pre-refacing cleaning.

PROVEN BY SERVICE

Reports of users in boiler rooms indicate that jobs which formerly took days now are reduced to hours. One man who had taken *an entire day* to reface *one handhole* with a file, completed *fourteen in five hours* with this Elliott Grinder!

Check on your own boiler room refacing methods. Get all the facts about this Elliott Handhole Seat Grinder now and cut outage and manhour losses. Write today.

Y-258

ELLIOTT Company

Lagonda Division, Springfield, O.
Plants at JEANNETTE, PA.—RIDGWAY, PA.
SPRINGFIELD, O.—NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

TOUGH LAYOUTS

- ✔ Assured Safety
- ✔ Efficient Operation
- ✔ Minimum Fuel Costs
- ✔ Low Maintenance
- ✔ Long, Trouble-Free Life

MADE SIMPLE BY NAVCO

The high degree of skill acquired by Navco Engineers from long experience in solving unusual Piping problems is your guarantee of an accurate and workmanlike Piping System.

Consult Navco for your next Piping job

NAVCO

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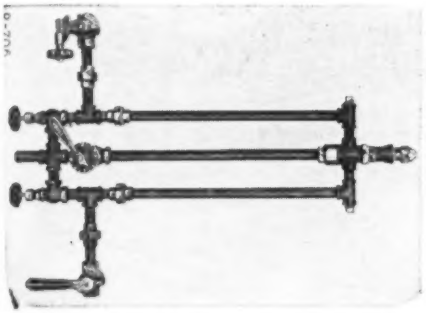
NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • TULSA • BUFFALO • CINCINNATI

TYPE S A D REFUSE OIL BURNER



MAINTAINS . . .
STEADY IGNITION

. . . IS *EASY*
TO REGULATE

NATIONAL AIROIL BURNERS
for FUEL OIL
. . . for GAS

B U R N S . . . ACID, OIL OR SLUDGES, ASPHALTS, STORAGE TANK BOTTOMS. SETTLING POND SKIMMINGS, POLYMER RESIDUES, HEAVY PETROLATUM, ETC. ***(DILUTED WITH WATER OR OTHERWISE)***

This smooth functioning Oil Burner is widely used in leading refineries, because: (1) it burns without difficulty, the liquid or semi-liquid material available as part fuel or for disposal, (2) it consumes material which is so low in heat value as to present, ordinarily, a combustion problem.

The S A D maintains constant ignition, and is designed to prevent discharge of objectionable fumes and solids from the stack. Not only stability of ignition, but also ease of oil flow is assured, as the S A D (steam or air atomizing) burns fuel in suspension; a portion of regular fuel oil being mixed with the refuse oil.

After the furnace is well heated, in some cases no regular fuel oil is needed. The burner functions entirely on fuel oil when the supply of refuse is exhausted. Steam consumption is very low, and operation is continuous, without clogging or interruptions for cleaning.

SIGN AND MAIL THE COUPON . . . get our Bulletin #21 regarding the Type S A D Burner and other National Airoil Burners. We have had nearly 35 years' experience as designers and manufacturers of fuel oil and gas burner equipment. If you have a combustion problem, perhaps we can help solve it.

NATIONAL AIROIL BURNER

National Airoil Burner Company, Inc.
1250 East Sedgley Avenue
Philadelphia 34, Pa.

Gentlemen: Please send me your Bulletin #21 including complete information on the Type S A D Oil Burner.

FIRM .....

ADDRESS .....

CITY .....STATE.....

NAME .....TITLE.....

NATIONAL AIROIL BURNER Company, Incorporated

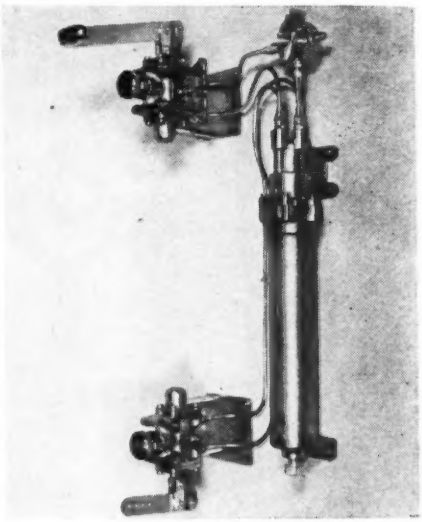
1250 EAST SEDGLEY AVENUE, PHILADELPHIA 34, PENNA.

Texas Office: 2nd National Bank Bldg., Houston

OIL BURNERS • GAS BURNERS • GAS PILOTS • PUMP SETS • EXPLOSION DOORS
ACCESS DOORS • AIR DOORS • BURNER BLOCKS • FURNACE OBSERVATION WINDOWS

it is cold worked. Thus at all times, beneath the surface a cushion of softer metal remains, according to manufacturer, which eliminates checking and flaking. *Abrasoweld AC* is available in $\frac{1}{8}$- $\frac{5}{32}$- and $\frac{3}{16}$-in. sizes in 14-in. lengths.

Manganweld A, suspended for the duration, has been improved and is now manufactured for reclaiming worn austenitic manganese-steel parts containing 11 to 14% manganese. It is particularly suited for dc machines and may be employed with industrial ac and small welding machines. Generally recommended for flat work only, *Manganweld A* electrode produces a flat bead and melts uniformly with minimum spatter. This improved electrode is in $\frac{5}{32}$- $\frac{3}{16}$- and $\frac{1}{4}$-in. sizes and 14-in. lengths. **Lincoln Electric Co, Cleveland, O.**



Hydraulic Control

SMOOTH, POSITIVE, dependable operation comprise claims advanced by its manufacturer for a throttle, governor and clutch control now applicable for marine use. Its reputed instant response to remote control from distances up to 150 ft and its transmission of torques up to 500 in.-lb make this control of interest to the general industrial field. **Ellinwood Industries, 150 W Slauson Ave, Los Angeles 3, Calif.**

Pressure-Operated Switches

THREE BASIC UNITS automatically start or stop pumps, motors, warning devices, close or open valves, actuate counters and maintain desired pressures.

Type A is for those applications where a fixed value of pressure differential is satisfactory and no future adjustment is required. Various stock models are available to operate from 25 to 3000 psi; higher pressures to cover special applications are built to order. Minimum operating pressure tolerance (dependent upon model *Micro* switch employed) is plus or minus 10 psi. Unit is available in either SPST, normally open or normally closed, or SPDT.

Type B is for those applications where an adjustable pressure differential is required—that is, where the electrical circuit is opened at one predetermined operating pressure and

(*Continued on page* 200)

For an Important

INCREASE IN PROCESSING LINE PERFORMANCE

1. MAXIMUM CAPACITY WHEN NEEDED MOST
2. ACCURATE PRESSURE CONTROL UNDER TOUGHEST WORKING CONDITIONS
3. TROUBLE-FREE SERVICE
4. SMOOTH OPERATION
5. TIGHT CLOSURE
6. ACCURATE REGULATION
7. SPEEDIER PRODUCTION RESULTS
8. ELIMINATION OF FAILURES
9. CONSTANT DELIVERY PRESSURE
10. COST SAVING OPERATION
11. NO SPOILAGE
12. PRACTICALLY ZERO IN MAINTENANCE COSTS

The "1000" Valve, upon installation, goes to work smoothly and effectively without that frequent attention ordinarily experienced.

You don't get those valve "kick-ups" that cause production delays and figure mighty costly over a given period.

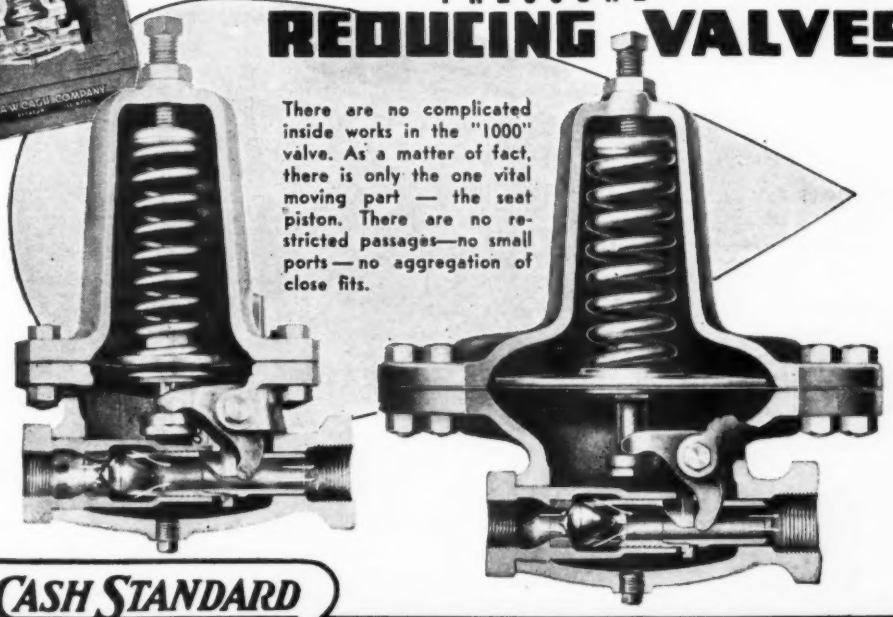
"Straight line flow" which is incorporated in the "1000" valve design is the reason you avoid valve troubles.

To find out how this "STREAMLINED" design works to your advantage in elimination of failures, speedier production, no spoilage, and in lower costs, send for Bulletin 962.

Bulletin 962

CASH STANDARD Streamlined TYPE 1000 PRESSURE REDUCING VALVES

There are no complicated inside works in the "1000" valve. As a matter of fact, there is only the one vital moving part — the seat piston. There are no restricted passages—no small ports — no aggregation of close fits.

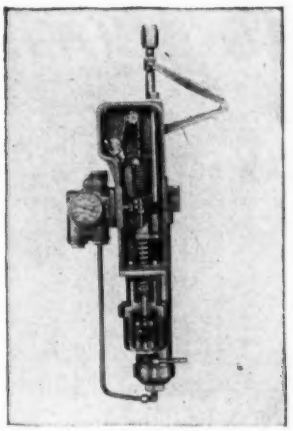


CASH STANDARD CONTROLS.. VALVES

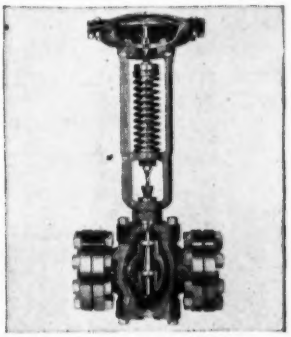
A. W. CASH COMPANY
DECATUR, ILLINOIS

BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

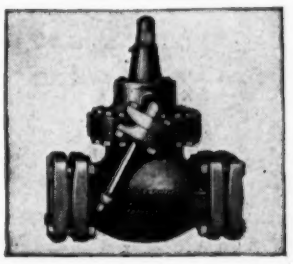
Send for them



Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers — various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.



Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve — direct operated — direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.



Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

"You don't have to be no watchmaker to work on Hagan Control"

Back in 1936, we installed Hagan Automatic Combustion Control on the first two high-pressure boilers in a large eastern plant.

Three years later, another boiler was installed, and again Hagan Control was specified.

Then, deciding that they should have first-hand knowledge of the performance of other control systems, the engineers installed a well-known instrument type of control on the next boiler, in the low pressure section of the same plant.

Now, one more boiler is going in—and Hagan Control is again specified. The veteran boiler room superintendent put his reasons into a single emphatic statement—"You don't have to be no watchmaker to work on Hagan Control."

The same simplicity of design that makes it possible for any competent mechanic to attend to the maintenance of Hagan Control is also largely responsible for its ruggedness and dependability, and for its continued high accuracy over long periods of time.

Hagan Control will function efficiently with any size, type or make of boiler. The services of our engineers are available, without charge or obligation, to aid in planning boiler installations.

HAGAN
HALL
BUROMIN
CALGON

HAGAN CORPORATION, HAGAN BUILDING, PITTSBURGH 30, PA.

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader

JEFFERSON *Specialty* UNIONS

offer the

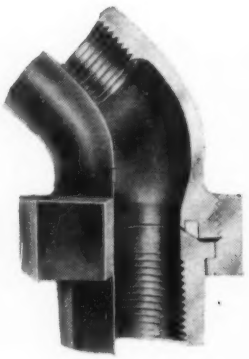
EXCLUSIVE RECESSED BRASS SEAT

Save Pipe Joints and Assure Permanent Tightness

With a complete line of Specialty Unions available for all piping requirements, Jefferson makes it possible to standardize on a tried and proved means of assuring permanently tight piping systems.

Common to all Jefferson Unions is the Brass Seating Ring located in a recess away from the runway of the fitting. The manner in which this ring is inserted and its location assure its protection from pipe ends no matter how far they are screwed in to the fitting. Then, too, seating surfaces are machined and ground together in pairs with seating surfaces of a true arc of a sphere assuring a permanently tight and self-seating ball joint.

Jefferson Unions can be used over and over again without seats rusting or pitting.



Jefferson 45° All-Female Union Elbow.

Consult us or your nearest distributor for further information.

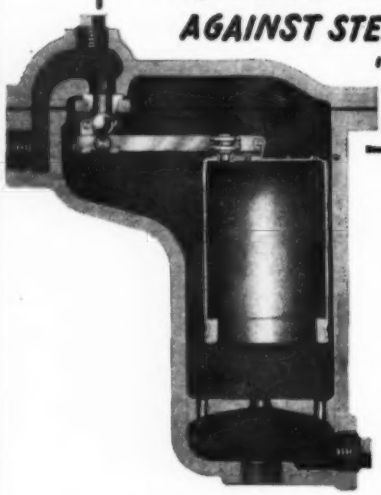
JEFFERSON UNION CO.

601 West 26th St., New York 1, N. Y.

LEXINGTON 73, MASS. LOCKPORT, N. Y.

CRYER PERFORMANCE *is YOUR PROTECTION AGAINST STEAM LINE TROUBLES*

"All's Well With CRYER TRAPS"



Sizes ½" to 2½"

Capacities: 500 to 38,000 lbs. of water

Pressures: 0 to 250 lbs.

We carry all sizes of traps and repair parts for the line formerly known as the J-M Ball Steam Trap.

Slow venting . . . binding . . . inadequate capacity . . . high maintenance are some of the typical difficulties experienced by steam trap users, which have proved costly in operating efficency, time and wasted fuel.

You can avoid all this trouble and expense and assure proper, carefree, economical performance by installing Cryer traps on your steam lines. Experience in plant after plant (details on request) discloses that Cryer traps are positive in action, accessible, non-binding, quick venting, high in capacity and require practically no attention. In many plants, Cryers are the standard by which trap performance is judged. Cryer users are invariably Cryer boosters.

Ask for detailed information and the CRYER PERFORMANCE GUARANTEE — a guarantee that really protects you as a Cryer user.

Manufacturers of Steam Specialties for over 40 years

CRYER TRAP AND VALVE CO., INC.

366 MADISON AVE. NEW YORK 17, N. Y.

closed at another predetermined operating pressure. Minimum pressure differential is 200 psi and maximum 1000 psi; tolerances at these operating pressure settings are plus or minus 25 psi. In addition to main contacts of switch, a low amperage warning circuit may be operated at any desired pressure within the operating range of a given model.

Type C unit operates by vacuum chambers or various low-pressure air or noncorrosive gas-flow systems (to 25 psi). When in an evacuated system, controlling pressures act on outer surface of diaphragm; when in a system from zero to 25 psi, controlling pressures act on inner surfaces of diaphragm and make possible incorporation into a system controlled by pitot pressures. Minimum differential is one in. of mercury below zero psi. Above zero to 25 psi, minimum differential is three in. of water. **Meletron Corp, 950 N Highland Ave, Los Angeles 38, Calif.**

Portable Test Set

DUPLEX FYRITE TEST SET comprises two separate, portable indicators, one for direct carbon-dioxide analysis, the other for direct oxygen analysis. Instruments are packed in a compact carrying case, together with aspirator and rubber hose for connecting either to the desired sampling point.

Both instruments employ fundamental principle of chemical absorption and therefore give readings that are independent of voltage, humidity, temperature or atmospheric-pressure conditions. Operation of both indicators is identical. Set is suitable for many field and shop tests, including checking oxygen content in process gases, heat-treating atmospheres, hydrogen-cooled generators, and in the nitrogen over the oil in large transformers; measuring oxygen and carbon-dioxide content of flue gas, storage atmospheres, etc. **Bacharach Industrial Instrument Co, 7000 Bennett St, Pittsburgh 8, Pa.**

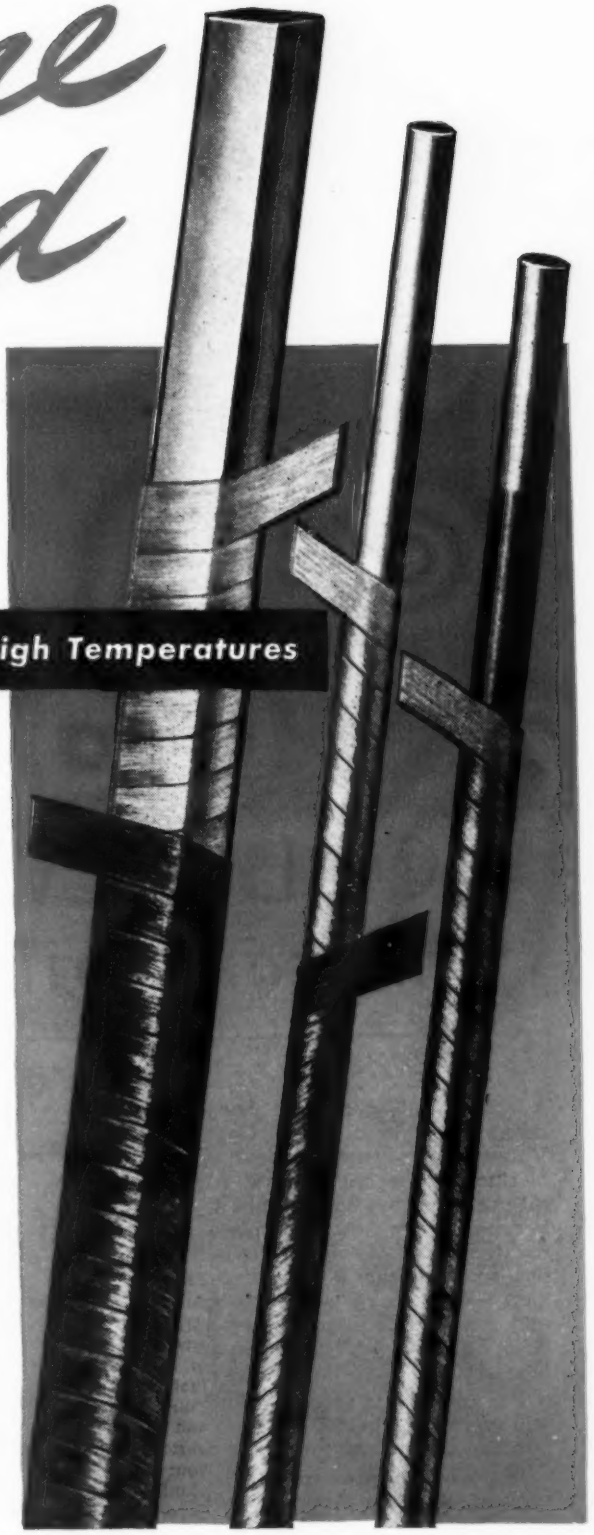
Sealing Compound

GENERAL-PURPOSE thread and gasket-sealing compound, known as *Uniseal*, is said to be proof against air, water, steam, gas, gasoline, oil, hydraulic fluids and aromatics. A paste of uniform consistency, it contains no free metallic particles that might set up corrosion because of galvanic action or other additives subject to washing out. Compound flows smoothly to form ribbon gaskets and blends readily with cut-gasket material. *Uniseal* possesses good anti-seize characteristics that

Silicone Treated

DELTAGLASS MAGNET WIRES

Provide Remarkable Resistance To High Temperatures



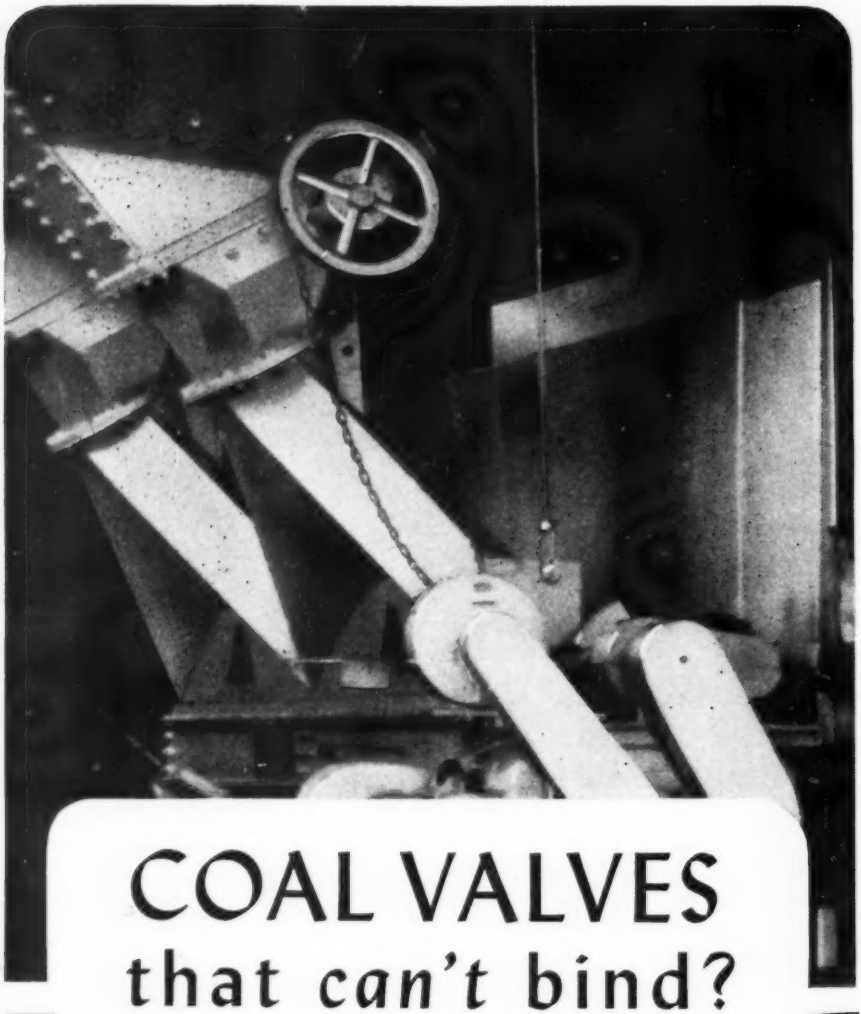
One of the most recent developments to come out of General Electric's research laboratory is the new Silicone-treated Deltaglass Magnet Wire. Because Silicone resin offers remarkable immunity to high ambient temperatures this new magnet wire is highly recommended for electrical equipment which operates in temperatures in excess of those that can be met with conventional Class B insulation.

The new Deltaglass Magnet Wires are insulated with a yarn of pure, continuous spun glass that is firmly bonded to the copper with a special Silicone compound to withstand constant, high heat. They are made with either single or double wraps of glass yarn. Silicone-treated Deltaglass is smooth, tough and flexible—particularly suitable for winding motors, lifting magnets, brake coils, generators, etc. It can be wound into the most intricate coils without rupturing the insulation. It's available in round, square and rectangular shapes in a complete range of sizes.

Do you have a magnet wiring problem where excessive heat is essential? You can obtain additional information about Silicone-treated Deltaglass by writing to Section Y464-52, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn. All Deltabeston Asbestos-, Glass- and Synthetic-insulated Wires and Cables are distributed by Graybar Electric Co., G-E Supply Corp., and other G-E Merchandise Distributors.

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EST, NBC, "The World Today" news every weekday 6:45 P.M. EST, CBS. "The G-E House Party" Monday through Friday 4:00 P.M. EST, CBS.

GENERAL ELECTRIC



COAL VALVES
that can't bind?

• The "twin" gear and rack arrangement in S. E. Co. Coal Valves means positive, square closing of the valve gate at all times. The gate, because it is driven by two gears and two racks, works smoothly and easily—so easily that it will amaze you. All working parts are completely shielded so that coal and moisture can't cause deterioration—further guarantee that S. E. Co. Coal Valves will open and close all the way at all times.

It's S. E. Co.
double rack and double pinion
Coal Valves!

For valves that represent fine engineering — for valves that will *work*, whether in constant operation or standby use—you can't do better than to specify S. E. Co. Coal Valves.

Engineering drawings and illustrated bulletins will be sent on request. Address **Stock Engineering Co., 715 Hanna Bldg., Cleveland 15, Ohio.**

STOCK
ENGINEERING CO.

★
CONICAL
Non-Segregating
Coal Distributors
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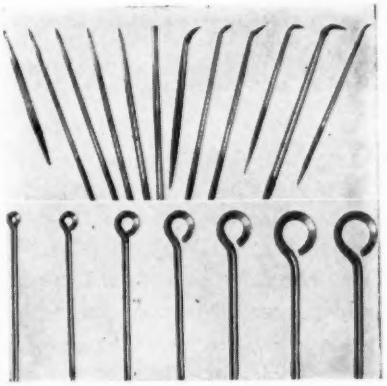
S.E.CO.
Coal Valves and Coal Scales

aid in assembly of threaded fittings. Solubility in alcohol and carbon tetrachloride simplifies any necessary cleanup. *Uniseal* is claimed to be effective under severe conditions of vibration and at temperatures above 300 F. It will be available in tubes and containers ranging from 8 oz to 5 gal. **Parker Appliance Co, Cleveland, O.**

Key Kit

HALLOWELL KEY KIT, for driving socket set and cap, Phillips and slotted head screws, consists of a compact speed tool with a selected group of essential bits. This tool, though light, is exceptionally strong and provides real leverage for a hard pull. With just one insertion of necessary bit for job, one has following tools: (1) Straight-handle screw driver (2) angle wrench for hard-to-get-at places (3) ell handle wrench for an extra hard pull. **Standard Pressed Steel Co, Jenkintown, Pa.**



Deburring Tools

HAND-FORGED DEBURRING TOOL LINE features seven models, each in varying sizes. Channel knife comes with sharp or square point to remove burrs from long channels and holes in machined castings. For deep holes or cross channels, there are 45- and 90-deg angle hooks, as well as radius-curved ends, in long or extra-long sizes. Series F straight scraping tool is for general scraping jobs, but is prescribed particularly for removing exterior burrs on machined castings. A "button-hook" shaped deburrer comes in seven separate graduations. Complete line is made of fine tool steel, unimpeded operating shafts from 4½ to 9 in. in length, hollow-ground, hardened and specially tempered. **Metal Products Co, South Bend 24, Ind.**

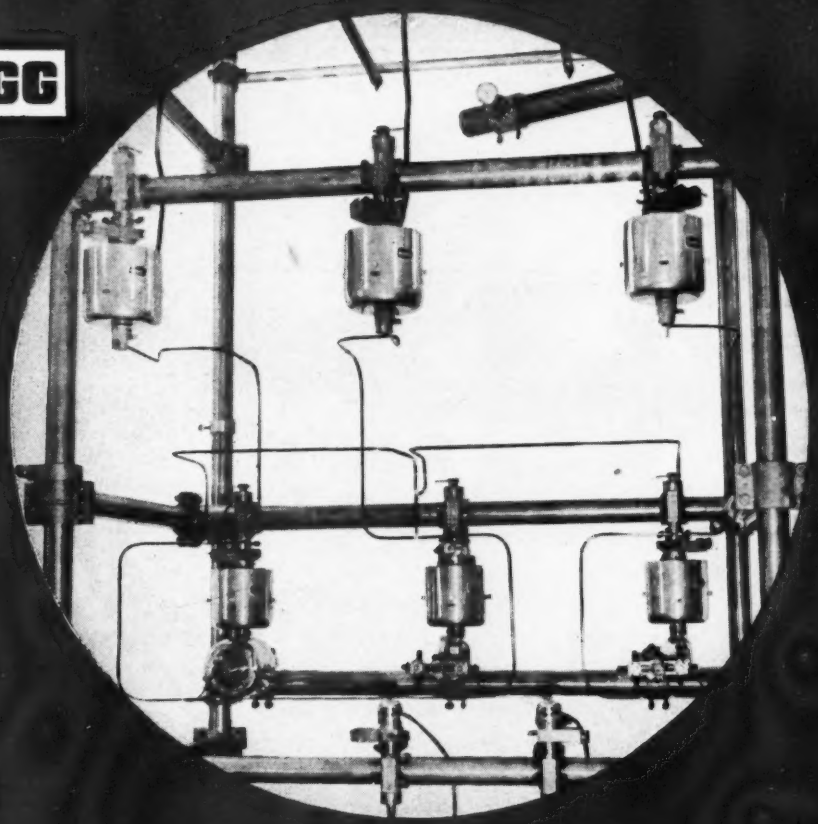
Welding Electrodes

COMPANY ADDS TWO NEW GROUPS of high-tensile arc-welding electrodes to *Murex* line. They provide two complete series of all-position high-tensile electrodes—one having an AWS-ASTM XX10 coating and the other a coating of the AWS-ASTM XX13 variety. Individually, there are eight electrodes in all, classified as AWS Grade E-7010, E-8010, E-9010 and E-10010, all for dc with reverse polarity, and a companion electrode to each having an XX13 coating for ac or for dc with straight polarity.

Developed to meet requirements of fabricators of power-plant piping and equipment,

KELLOGG MODEL TESTING APPARATUS

set up for determining end reactions and stresses in 1250 psi, 900 F. steam line

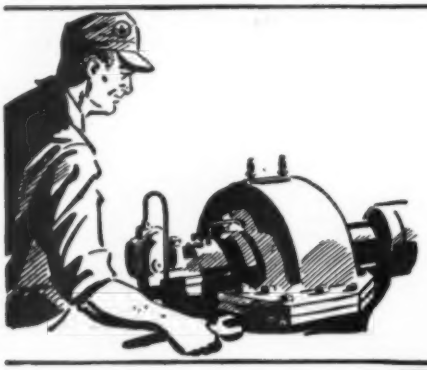


THE M. W. KELLOGG COMPANY · JERSEY CITY, NEW JERSEY · 225 BROADWAY, NEW YORK 7, N. Y.

REPRESENTATIVES

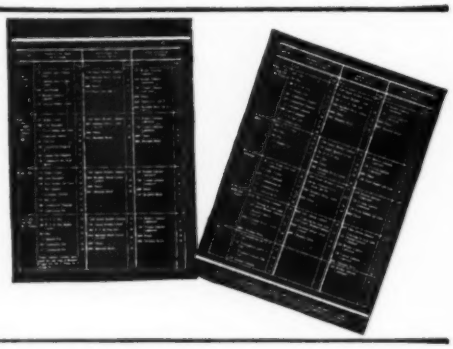
LOS ANGELES: 609 SOUTH GRAND · HOUSTON 2, TEXAS: 402 ESPERSON BLDG. · TULSA: PHILTOWER BLDG.

3 STEPS TO FEWER PACKING REPLACEMENTS



1. Make up your mind to put an end to power-wasting leaks and frequent time-wasting replacements.

2. Ask the Belmont distributor to show you the handy PACKING RECOMMENDATION CHARTS.



3. Standardize on the right Belmont packing at every point.

Belmont Distributors are located in every large industrial center, ready to serve you promptly from local stocks. Get the PACKING RECOMMENDATION CHARTS from the one nearest you — or send the coupon to us.

THE BELMONT PACKING & RUBBER CO. — BELMONT — PHILADELPHIA, U.S.A.

on the blue-and-orange box

THE BELMONT PACKING AND RUBBER COMPANY
Butler & Sepviva Streets, Philadelphia 37, Pa.

Gentlemen: Please send PACKING RECOMMENDATION CHARTS for the services checked:

☐ Steam . . . ☐ Hot Water . . . ☐ Cold Water . . . ☐ Brine . . . ☐ Ammonia . . .
☐ Acids & Caustics . . . ☐ Air . . . ☐ Gas . . . ☐ Oil . . . ☐ Gasoline . . .
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Name .....
Company .....
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but applicable to a variety of welding applications involving high-tensile steels, these electrodes provide and make it possible to select weld metal closely matching many high-strength steels in tensile strength and ductility. Electrodes depend for their mechanical properties on graduated alloying contents of chromium and molybdenum. **Metal & Thermit Corp, 120 Broadway, New York 5, N. Y.**

Carburetor

WATER INJECTION has been adopted for the *Vanderpoel* carburetor. A regulated and controlled amount of water, or alcohol-water, is injected through airhorn of gasoline carburetor and into air stream, thus combining with the fuel-air mixture. Water vapor, in mixture with air and petroleum gases, acts as an internal coolant, controlling high temperatures and peak pressures, suppresses detonation and pre-ignition, according to maker, increases combustion time period of the fuel and draws higher power output from engine. Moisture is flashed into steam in cylinder at time of the explosion, contributing power and also dissolving carbonaceous gums from around rings, valves and plugs. Company states that a 10% leaner main fuel metering jet may be used in gasoline carburetor. **Exola Products Co, 2423 E 57th St, Los Angeles, Calif.**

Pressure Switches

THREE 8-OZ SWITCHES have been developed for either pressure or vacuum up to 200 psi, in control of liquids or gases that will not corrode brass. Typical applications are to control compressors, pumps, carbonated beverage equipment. It is rated at 10 amp on 110-v ac. Model M-500 has an externally adjustable range with a fixed differential. Model M-600 can be reset manually from the outside. Model M-700 has an adjustable differential. Contact arrangement in the first two can be specified as normally closed, normally open or double throw. The third design is available only with normally open contacts. Pressure connection is by a ⅛-in. pipe nipple. **Aerotec Co, White Plains, New York.**

Oxygen Recorder

AUTOMATIC CONTINUOUS ANALYZER indicates and records oxygen content of a gaseous mixture. A continuous gas sample is mixed with a vaporized liquid fuel and burned on a catalyst filament, which reaches a temperature proportional to oxygen content. The filament resistance is a function of temperature, and a simple resistance bridge is connected to a null-balance electronic recorder, which may be calibrated in excess air, per-

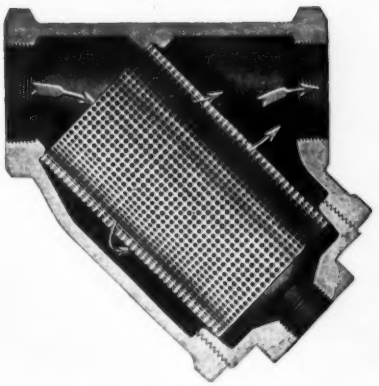
NOW! POSITIVE PROTECTION from Abrasives

for Instruments, Regulators, Pumps, Traps, Meters, etc.

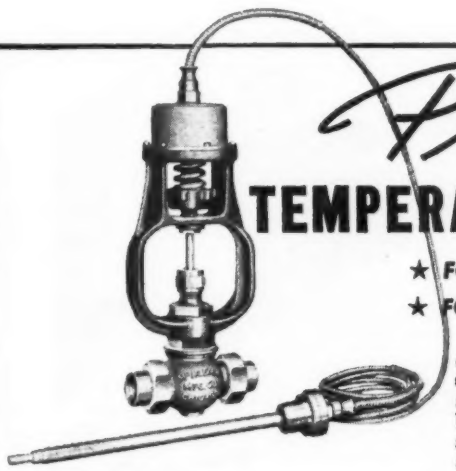
Installed ahead of regulators, pumps, traps, etc., McAlear No. M-530 Strainer positively removes all grit, pipe cuttings and other abrasive materials from pipe lines. It is instantly cleaned by opening of blow-off in flange.

BODY is precision-machined cast iron with screwed ends. Monel metal 20-mesh (400 holes per square inch) is standard. 40-mesh (1600 holes per square inch) available on special order. Working pressures up to 125 p.s.i. Sizes ½" to 2" available for *immediate* delivery.

For informative bulletin, write McAlear Manufacturing Company, Automatic Control Division of Climax Industries, 1913 S. Western Avenue, Chicago 8, Illinois.



McALEAR No. M-530
New High Quality, Low-Cost, Self Cleaning Y-Type Strainer—with Monel Metal Basket



EXTRA SENSITIVE, accurate, easily adjusted new McAlear No. M-3101 (self-powered) Temperature Regulator for steam, water or gas.

Precision

TEMPERATURE CONTROL AT LOW COST

★ ***FOR PROCESS INDUSTRIES***
★ ***FOR HEATING APPLICATIONS***

STANDARD temperature range: 140° to 180° F. Sizes: ½ to 2 inches. Construction: Union ends, double port, bronze body, bulb and fittings standard. Spiral wound, brass armored tubing standard length 8 feet. Other sizes available in ranges of 40° each from 70° to 260° F.

This new McAlear No. M-3101 incorporates all the advanced features developed by McAlear in 35 years of building temperature controls for heating and processing. Trim, compact and rugged, it establishes new standards of sensitivity, dependable accuracy and easy adjustment. Write for bulletin.

CLIMAX INDUSTRIES

McALEAR
PRESSURE · FLOW · LIQUID LEVEL · TEMPERATURE
controls
for STEAM, WATER, AIR, OIL-GAS

THE PACKING for EVERY PURPOSE

Stops Leaks — Prevents Scoring

ALLPAX

This universal packing — consisting of long, tough fibrous asbestos fibres, thin flakes of anti-friction metal, minute graphite scales and a heat-proof lubricant — is recommended for general service against steam, water, air, ammonia, oils, gases, etc. where temperatures do not exceed 600°F. Fits all sizes and shapes of stuffing boxes. Special styles available for high temperature and corrosive liquids, for products, etc. Try it and you'll use it regularly.

Distributors everywhere

THE ALLPAX CO., INC., MAMARONECK, N. Y.

TESTED for ACCURACY

All tubing from which Pyrex and Corning Gauge Glasses are made is drawn on specially designed machines which draw the tubing to uniform accuracy. That is why breakage due to installation strains is substantially eliminated—why these gauge glasses are easy to install.

Pyrex and Corning Gauge Glasses are made of glasses that are chosen with recognition of actual working conditions. They will give excellent service when used at pressures for which they are recommended. Remarkable resistance to the solvent action of steam and hot water and a hard smooth surface that resists scratching and abrasion are other factors which mean long life, economy and trouble-free performance.

"PYREX" and "CORNING" are registered trade-marks and indicate manufacture by Corning Glass Works, Corning, N. Y.

CORNING Glass Works Corning, New York

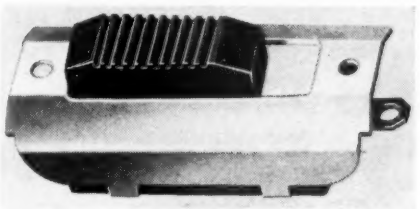
Pyrex Gauge Glasses BRAND

cent oxygen, or other desired terms. A high-speed sampling system for handling dirty, high-temperature gases is furnished with the instrument when required.

This oxygen recorder, applied to all furnaces operating with oxidizing atmospheres, permits closer regulation of fuel-air ratios, according to maker, especially where multiple fuels are employed or where firing rate changes rapidly. High speed makes instrument ideally suited for traverse studies and other test work, as well as continuous day-to-day operation. **Bailey Meter Co, Cleveland 10, O.**

Flexible Plastic Tubing

FIBRON TUBING withstands varnish treatment and baking operations without stiffening, according to maker, even in applications where extreme operating temperatures are encountered. It is also resistant to strong acids and alkalies, denatured alcohol, petroleum and its products, and coal-tar solvents. Tubing is said to perform satisfactorily in instances where high dielectric and tensile strengths are important. **Irvington Varnish & Insulator Co, Irvington, N. J.**



Snap Switch

E-4 SNAP SWITCH has an unusual torsional spring arrangement. It assures snap action and high-contact pressure. Other construction features are a formed-steel housing and heavy, laminated Bakelite base to provide structural rigidity and maximum insulation. It is actuated by a molded-Bakelite slide button. E-4 switch is supplied as single pole, double throw; single pole, single throw, normally open; or single pole, single throw, normally closed. It is rated at 300 watts ac, 3 amp at 115 v ac, ¾ amp at 115 v dc non-inductive. Switch is $1\frac{7}{16} \times \frac{5}{8} \times \frac{3}{16}$ in. wide. Its weight is about ½ oz. **Allied Control Co, 2 E End Ave, New York 21, N. Y.**

Center-Tap Resistor

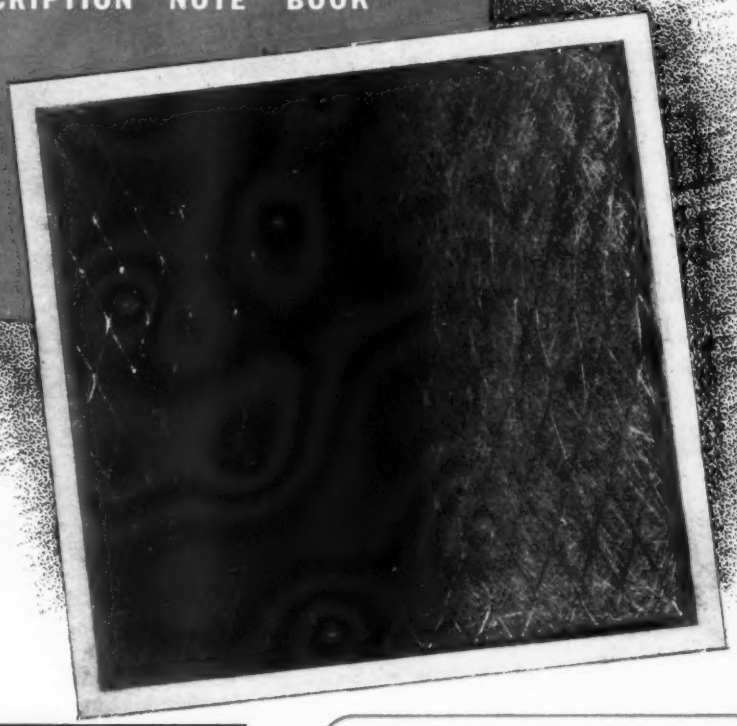
CAM CENTER-TAP RESISTOR consists of a core machined from a solid piece of steatite, upon which is wound a helical resistance-wire element. Center and end taps are half-straps securely clamped to the core, assuring absolute mechanical rigidity independent of support by the resistance element. It is claimed that the finest wire can be tapped off with positive assurance of a good non-heating connection.

CAM resistor is designed on same principle as Regan AVW and NC designs. If a unit is overloaded and burns out, coil can be removed and replaced in a few minutes by removing two nuts. Connections or supporting assembly need not be disturbed. Resistor developed by Regan Engrg Corp and distributed by **Techtmann Industries, Inc, 828 N Broadway, Milwaukee 2, Wis.**

PAGE 1

OAKITE "PRESCRIPTION NOTE BOOK"

ONE OF A SERIES of data sheets for power plant engineers outlining various Oakite maintenance and equipment cleaning tasks. Each sheet may be filed for reference to serve as a reminder for obtaining more specific information.



Cleaning Washable Type AIR FILTERS

FREQUENT cleaning of dry or viscous washable-type air filters is recommended to assure full filtering capacity. Operating conditions, dust load, type of impinged soil, adhesive and other deposits to be removed, including equipment available, generally determine the Oakite material and method recommended. Additional factors are whether filter mats are ferrous or non-ferrous metal or are fabricated from glass wool, spun glass or similar material.

Oakite Alkaline, Acidic and Solvent Materials Designed For Filter Cleaning

Whatever the type of air filter employed in your air conditioning equipment, the successful experience of Oakite Technical Service Representatives can prove valuable and helpful to you in handling this work on a low-cost, efficient basis. Moreover, from among the wide range of Oakite alkaline, acidic and solvent type materials at his command, there is one that will effectively and safely remove the great variety of deposits generally encountered in air filters, including slime, mold and lime scale. Write us today . . . we are at your service.

Other Power Plant Cleaning Jobs for OAKITE

Automatic Filters . . . Electrical Precipitators . . . Controlling Slime and Scale Formation in Air Wash Air Conditioning Units . . . Cleaning Evaporative Condenser Coils . . . Controlling Slime and Mold in Humidifying Systems . . . Cleaning and Descaling Diesel or Gasoline Engines . . . Cleaning and Descaling Jacket Water Coolers and Lube Oil Coolers . . . Cleaning Surface Condensers . . . Cleaning Water and Steam Condensate Meters . . . Descaling Water Cooled Compressors . . . Cleaning Unit Heaters . . . Descaling Ammonia Condensers . . . Cleaning Transformers . . . Cleaning Painted Surfaces of Equipment . . . Stripping Paint . . . Cleaning Floors.

NOTE: The Oakite Technical Representative in your locality is ready to give you the benefit of his experience and personal help on any power plant cleaning or related problem. This Advisory Service is free.

OAKITE PRODUCTS, INC. 23 Thames Street New York 6, N. Y.

Technical Service Representatives in All Principal Cities of the United States and Canada

OAKITE *Specialized cleaning*

MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

New, Small, 6 H. P. Size

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SCOTTIE JR BOILER

6 sizes for 6 to 30 H. P., 100 lbs. W. P. Low in first cost and economical to operate. Conveniently compact yet very accessible.

For 6" scale with pipe diameter markings . . . WRITE Dept. 99-K4

KEWANEE BOILER CORPORATION

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Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

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ADDED TO FLAME

REMOVES SOOT FROM BOILERS AND STACKS

INCREASES BOILER EFFICIENCY

YOU CAN CHECK the efficiency of XZIT in your boiler room. Stack temperatures definitely prove that XZIT substantially increases operating efficiency and improves heat transfer by removing soot and fire-scale from all surfaces of the firebox and stack.

XZIT, fed into the flame, does its work while the boiler is in operation. It keeps the boiler free of soot and fire-scale when used at regular intervals. Try XZIT today—stocks are available in all localities.

XZIT FIRE SCALE & SOOT ERADICATOR

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5800 S. HOOVER, LOS ANGELES, CALIF.

COMING

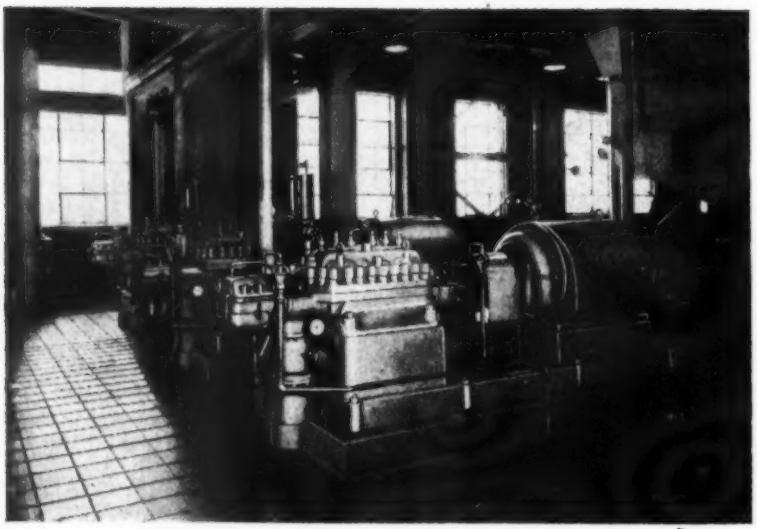
IN THE JUNE ISSUE OF POWER

A Special Section on

"POWER FIELD STATISTICS AND ANALYSIS"

Covering new plants—Steam, Diesel and Hydro—Installed since Pearl Harbor, this number will be a valuable guide on plant trends, pressures, temperatures, fuels and other data.

THRUST-TROUBLE FREE PERFORMANCE

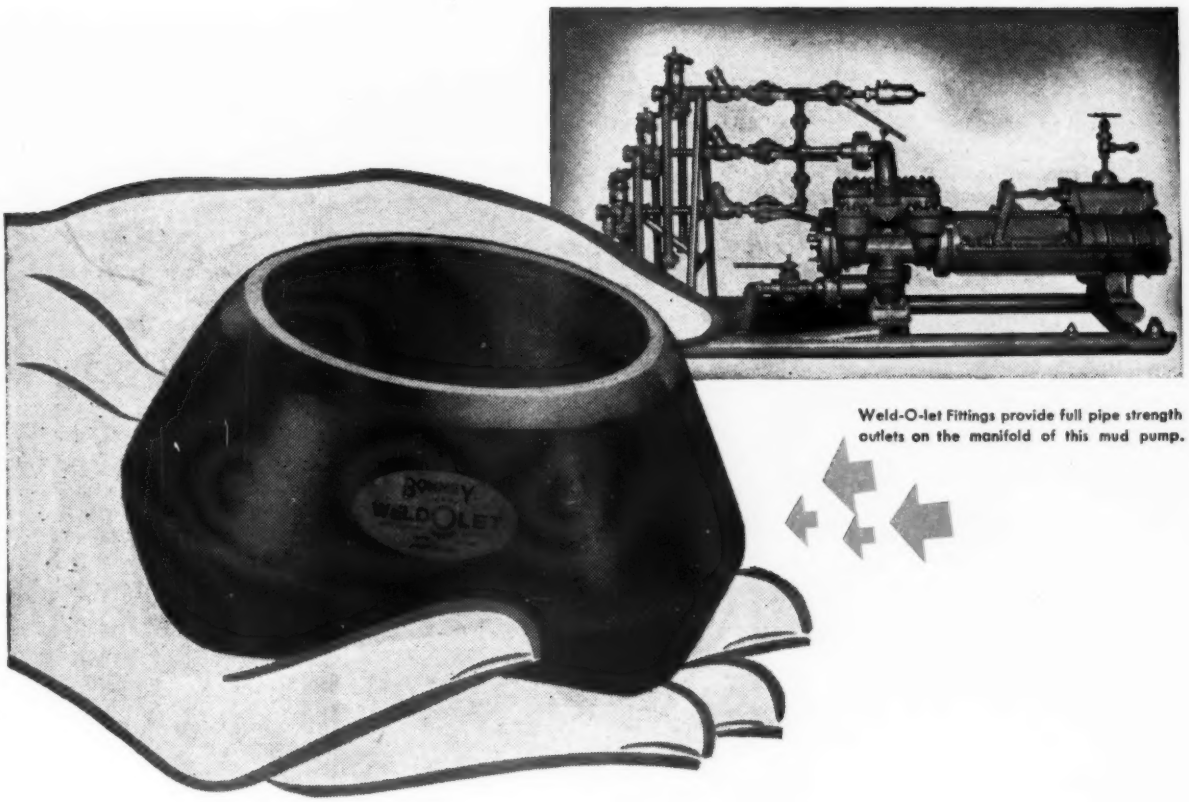


In Pennsylvania *Thrustfre* multi-stage centrifugal pumps dynamic hydraulic balance is effected without the aid of internal or external mechanisms. Result, thrust-trouble-free performance and elimination of thrust control devices with their attendant worries.

Descriptive Bulletin 238 on request.

PPC PENNSYLVANIA PUMP & COMPRESSOR CO.

BUSHKILL PARK ROAD, EASTON, PENNA.



Weld-O-let Fittings provide full pipe strength outlets on the manifold of this mud pump.

Weld-O-let Fittings give you full pipe strength at branch outlet

● Whenever branch pipe outlets are made on any piping system, dangerous internal and external strains are encountered. These strains can cause trouble unless careful consideration is given to adequate reinforcement of the joint. And in most cases, this necessary reinforcement is a costly and time-consuming job.

An easy way to solve these problems permanently is to use Weld-O-let Fittings wherever welded branch pipe outlets are called for. These modern fittings for either welded or threaded branch pipe connections are designed with a heavy external reinforcing rib. This rib *gives you full original pipe strength at the joint* and makes additional reinforcement unnecessary.

Get the complete story on these easy-to-install branch pipe fittings that give you full pipe strength joints and improved flow conditions. Write today for the new Weld-O-let Catalog.

Forged Fittings Division

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WELDOLETS
TRADE MARK REG. U. S. PAT. OFF.
PAT. IN U. S. & FOREIGN COUNTRIES
WELDING OUTLET - THREADED OUTLET - SOCKET OUTLET
For Welded Branch Pipe Outlets

Gives You

LONG, TROUBLE FREE SERVICE!

Fig. 1635

"STANDCO"

PILLOW BLOCKS

The attractive "Standco" Pillow Block shown above is sturdily built and is offered in a wide range of sizes. Babbitted and broached bearing surfaces, accurately machined faces. Can be amply lubricated.

Write for Bulletin

"Unbrako" and "Hallowell" products are sold entirely through distributors.

Over 43 Years in Business

STANDARD PRESSED STEEL CO.

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SAVE FUEL WITH

Sterling The Closed Condensate

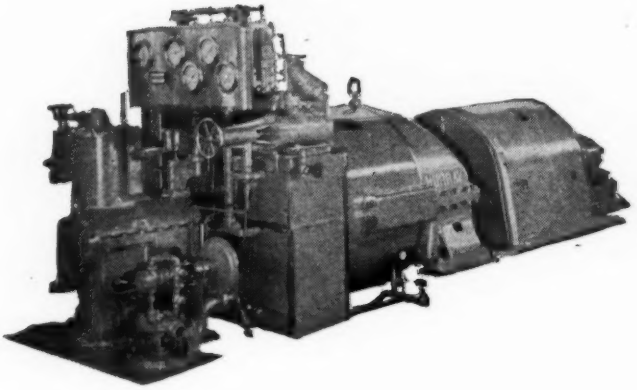
RETURN SYSTEM

This exclusive system handles all condensate and/or makeup water as fast as received, returning same to the boiler quickly and automatically without the loss of valuable heat-units.

Many users of this system are getting these benefits by having boilers fed with condensate in excess of 300 degree F. This means a big savings in fuel costs.

Sterling Engineering & Mfg. Corp.
(Templeton Mfg. Co.)
110 Business Street
Hyde Park, 36, Massachusetts

MURRAY
STEAM TURBINE GENERATING UNITS



Installed in 1939 in a small municipal power plant in northeastern Indiana, the above 500 KW direct connected Murray steam turbine generator set has given its owners entire satisfaction. The turbine is equipped with every device necessary for minimum of attention including steam turbine driven auxiliary oil pump. The generator and exciter may be furnished to match existing electrical equipment in your plant.

Units in this size may be furnished either direct connected or geared as preferred with performance and operation equally trouble-free.

There is a Murray representative ready to help you with design and layout information.

MURRAY *also produces*

Mechanical Drive Turbines—Horizontal and Vertical Reduction Gears of the high speed type Steam Boilers

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA
Builders of Steam Power Equipment for Three Quarters of a Century

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RUGGED BWH CONVEYOR BELT!

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That, the operators told us, is a record to be proud of! But, our records show that similar dependable service is being rendered by other BWH belts in all types of industry from coast to coast . . . and at lower maintenance cost. Such ruggedness is due to the exclusive BWH ROTOCURE process of continuous vulcanization.

The dependability of BWH for producing conveyor belts and other products of remarkable toughness has established it as a leader in the industrial rubber goods field. So depend on BWH for dependable ruggedness . . . on BWH distributors for dependable service.

HAVE YOU A JOB WHERE STAMINA COUNTS?

Bring us your toughest problems . . . we're specialists in solving them. Consult your nearest BWH distributor, or write to BWH direct.

BOSTON WOVEN HOSE & RUBBER COMPANY

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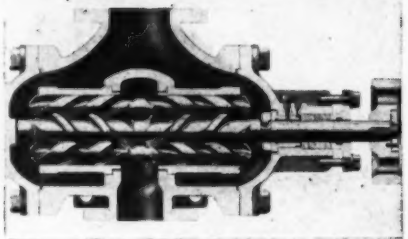

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made for
handling oils and other liquids
at all capacities and pressures
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USE IT AND PROVE IT SAND-BANUM

"The Entirely Different Boiler and Engine Treatment"

AUTOMATICALLY
Removes and Prevents Scale and Corrosion in Absolute Safety while your equipment operates.

And Still Backed by the Same . .

UNCONDITIONAL GUARANTEE

Try it entirely at our risk for 30, 60 or 90 days. It must perform to your entire satisfaction or you owe us nothing. No money in advance; not even shipping charges.

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and at other convenient points including leading supply houses
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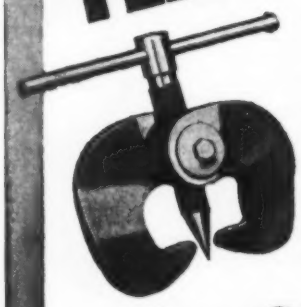
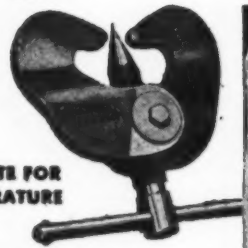
Schedule your shut-downs with
FLANGE JACKS



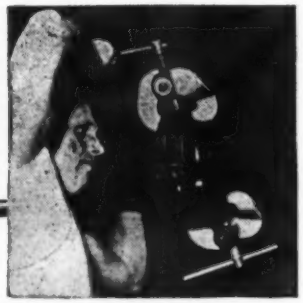
on any pipe line gasket replacement!

The only tool that takes the guesswork out of replacing gaskets, regardless of line pressure or location. Flanges are parted quickly and held in perfect alignment without damage to faces . . . shock and jarring of pipe lines are eliminated . . . there is no danger from flying wedges . . . no sparks caused by hammer blows. Flange-Jacks eliminate costly shutdowns, make possible fast, economical repairs in hard-to-get-at locations . . . offer maximum safety.



WRITE FOR LITERATURE

Write Dept. E for details or see your nearest distributor



MAXIMUM PROTECTION
to personnel and plant!

FLANGE JACKS are vital when replacing gaskets in presence of oil or gas fumes . . . eliminates hammer blows and sparks. FLANGE JACKS are a "must" in safety engineer specifications.

T. G. PERSSON COMPANY
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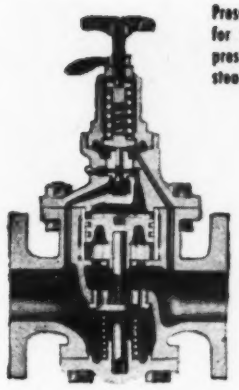
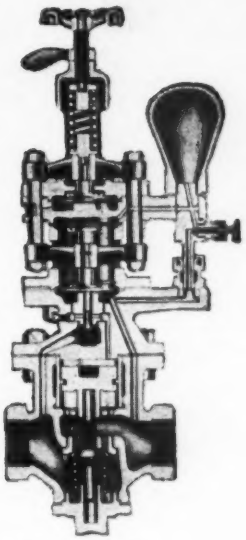
POWER IS KING

and LESLIE

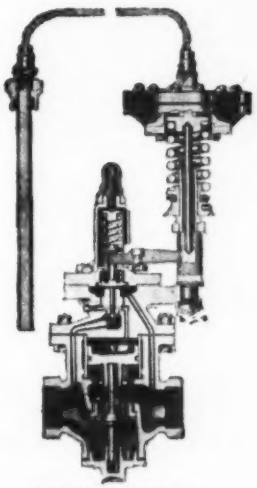
controls it automatically!



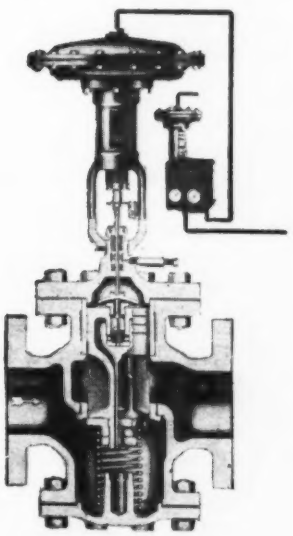
Pressure Reducing Valves for Steam and Air. Inlet pressures 25 psi to 600 psi steam, to 1000 psi air.



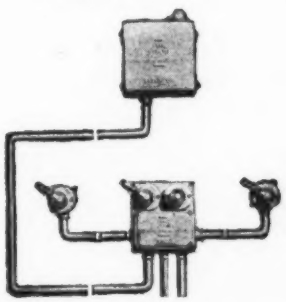
Constant and Excess Pressure Pump Governors. Available for pump discharge pressures 8 psi to 1000 psi.



Temperature Regulators for all types of heat exchangers.



Pressure Controller consisting of Control Pilot and Diaphragm Regulating Valve.



Automatic Whistle Control for either Alternating or Direct current.

Self Cleaning Strainer.

Pressure and Temperature Regulators control steam power accurately to the closest limits. Quick, automatic valve action under variable load conditions or sudden temperature changes, results in a minimum expenditure of steam.

Precision-built, ruggedly constructed, these long-life regulators feature, as **standard** trim, stellited seating surfaces, 800 Brinell surface hardened main valves, highly corrosion resistant internal parts — all unbeatable combinations engineered to lower your power costs.

Pressure Reducing Valves—self-contained, single seated for positive dead-end control. Respond instantly to widest and most sudden variations in load. Low maintenance cost—all internal working parts renewable—complete overhaul without removal from pipe line.

Pump Governors—give accurate control on either reciprocating or turbine-driven pumps. Single seated, metal diaphragms, handwheel adjustment—wide adjustable range. No packed plungers or stuffing boxes.

Temperature Regulators—have many applications, heating and cooling service. Rugged thermostatic element has 100°F adjustable temperature range. Direct acting or with "Duo-matic" (Pressure and Temperature) control for heating service.

Pressure Controllers—are air or water operated and are widely used when intermittent control of steam flow and emergency make-up or cut-off are required. No continuous leakage of air or water.

Strainers—protect all regulating equipment from dirt, rust and other foreign matter. Made in cast iron, bronze, cast steel or forged steel with screwed, flanged or welding end connections.

LESLIE CO. 255 Grant Avenue, Lyndhurst, N. J.

SEND FOR your copy of LESLIE Catalog of Engineering Data

Look for "LESLIE Regulators" in your classified telephone directory in these cities, for LESLIE factory-trained engineers to help you with your regulation problems:

Baltimore, Md.	Kansas City, Mo.	Portland, Ore.	St. Louis, Mo.
Boston, Mass.	Los Angeles, Cal.	Providence, R. I.	Syracuse, N. Y.
Bridgeport, Conn.	Louisville, Ky.	Richmond, Va.	Toronto, Ont., Can.
Chicago, Ill.	Milwaukee, Wis.	Rochester, N. Y.	Troy, N. Y.
Cleveland, Ohio	Montreal, Que., Can.	Rutherford, N. J.	Tulsa, Okla.
Dallas, Tex.	New Orleans, La.	San Antonio, Tex.	Vancouver, B. C., Can.
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Greenville, S. C.	Philadelphia, Pa.	Savannah, Ga.	Youngstown, Ohio
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ESTABLISHED 1900
LESLIE
REGULATING VALVES
LESLIE-TYFON WHISTLES

PRESSURE REDUCING VALVES • PUMP GOVERNORS • PRESSURE CONTROLLERS
TEMPERATURE REGULATORS • SELF CLEANING STRAINERS • LESLIE-TYFON WHISTLES

LESLIE CO. • LYNDHURST, N. J.

ADAMANT
FIRE BRICK CEMENT

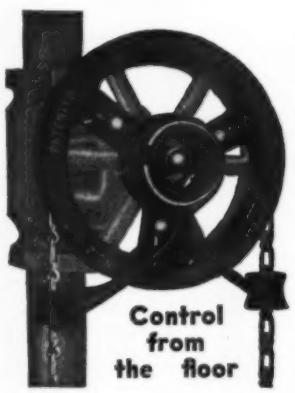
Its Strength INCREASES As Temperature RISES

Adamant . . . stronger by test. Impartial laboratory tests showed Adamant has a bonding strength of 800 lbs. at room temperature; 1270 lbs. at 2600° F. Bonding strength maintained throughout entire temperature range.

Lay-up linings with Adamant . . . its higher bonding strength protects the structure at the joints where failure usually begins. Result . . . linings last longer . . . production is maintained . . . repair costs and replacement materials saved. For more details, write:

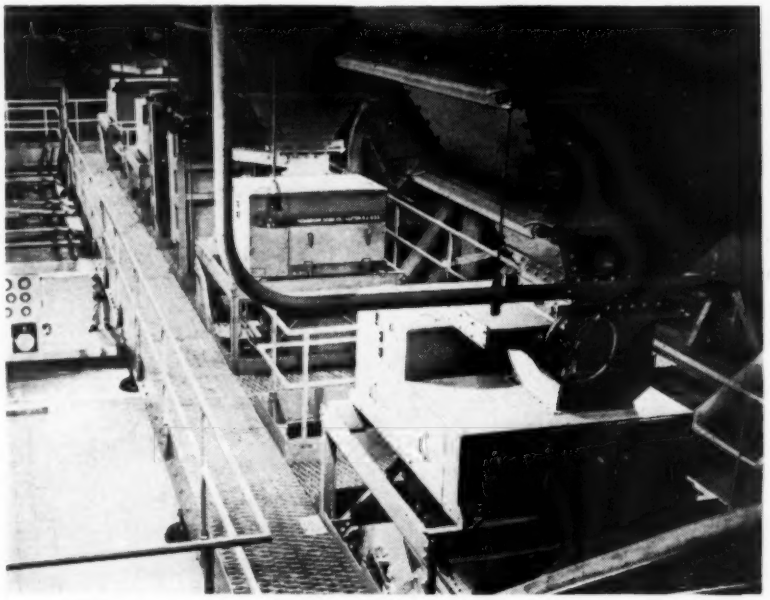
BOTFIELD REFRACTORIES CO.
784 S. Swanson St., Philadelphia 47, Pa.
In Canada, Canadian Botfield Refractories Co., Ltd., 171 Eastern Avenue, Toronto

Make Your Overhead Valves SAFE and Easy to Reach---



With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.
New Bedford, Mass.



2-WAY FUEL ECONOMY!

with a RICHARDSON coal-weighing system

Distributes coal evenly

points out

"Slacker" boilers

When your plant is going full blast you need a Richardson Coal-Weighing System to assure peak performance from every boiler . . . and help keep your steam costs down. The Richardson Coal-Weighing System lets you know—in a hurry—whether you're getting maximum output from *every single boiler on the line.* It points out "slacker" boilers and saves you money in coal. This 2-way fuel economy works like this:

• *The Richardson Automatic Coal Scale*—heart of the Richardson Coal Weighing, Conveying and Feeding System—weighs and records every pound of coal burned. By giving you accurate, indisputable records of coal consumed per hour, per shift, per day or week, it tells you which boilers are lying down on the job. It spots possible losses, right at the source. From these records, too, evaporation rates and other efficiency factors can be determined.

• *The MONORATE* Non-Segregating Spreader assures even distribution of coal across the stoker hopper without separating coarse and fine coal. This makes for even combustion . . . more efficient, even burning.

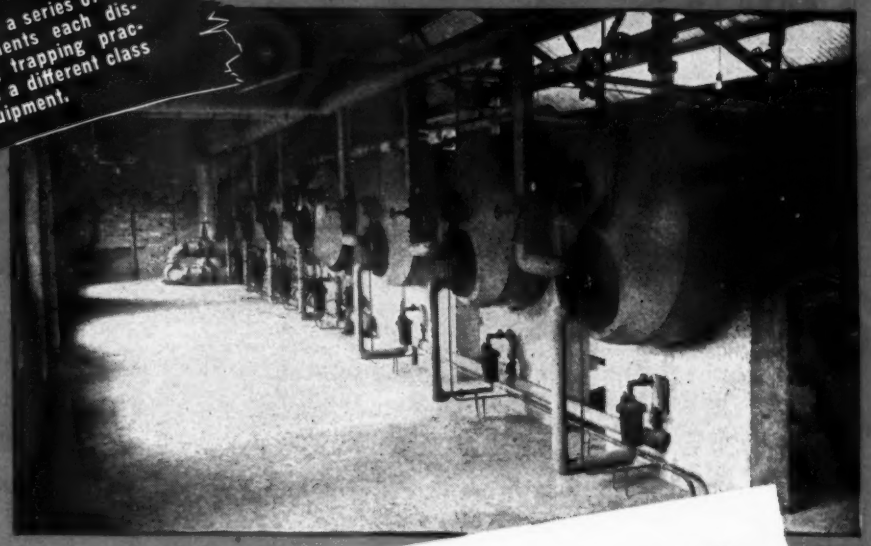
The Complete Richardson System includes: Gate from the bunker; flexible Inlet to scale; the Automatic Coal Scale; the Monorate Distributor. Richardson Automatic Coal Scales come in models suited to *your* space and needs . . . stationary floor-mounted models, stationary and portable models mounted at mid-section, and combination Conveyor and elongated Scale.

Bulletin 1143 has proved to the satisfaction of many that a Richardson System pays off in the more economical use of coal. Write for *your* copy today.

1432

RICHARDSON SCALE CO.
CLIFTON, N. J.
Atlanta • Boston • Chicago • Omaha • Montreal • New York • Philadelphia
Minneapolis • Detroit • San Francisco • Toronto • Wichita • Pittsburgh

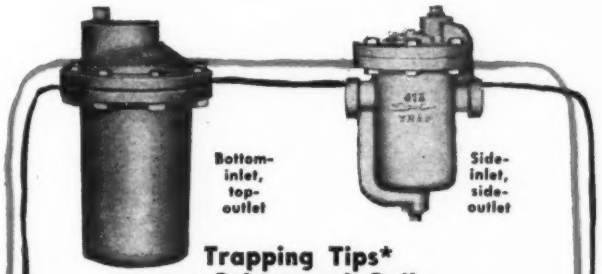
One of a series of advertisements each discussing trapping practice on a different class of equipment.



HOW TO TRAP

SUBMERGED COILS AND TUBES

. . . for higher temperatures



Trapping Tips* on Submerged Coils

- Use a trap on each unit.
- Install trap close to and below unit being drained.
- Use traps that automatically discharge air along with condensate.
- Use traps that discharge condensate at *steam temperature*.
- For extra fast heating, use traps with extra air handling capacity.
- Use adequate safety factor to handle peak loads.

*The ARMSTRONG STEAM TRAP BOOK contains complete data on trap selection including calculation of condensation and heat transfer rate plus recommended *safety factors*. Ask for a copy.

Packing Company Cuts Cooking Time 57%

Selection of steam traps for efficient drainage of condensate from evaporators, storage and instant water heaters, reboilers, ammonia generators, oil tank heaters, and simple open tank heating coils requires *experience* as well as engineering theory. Factors such as circulation, condition of coils, etc., have such a marked effect on condensation rates that calculations are complex and sometimes useless. Armstrong has unequalled experience required for solving these problems—gained on thousands of installations. That's why Armstrong users get results like these:

Duluth Company cuts cooking time 57% —from 8 down to 3½ hours.

Canadian cannery eliminates need for extra boiler after installing 7 traps.

Plating company increases production, improves quality of work, saves coal.

Chemical company saves $25 per day on fuel.

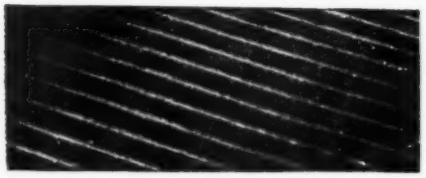
For a survey of your needs, address: ARMSTRONG MACHINE WORKS, 812 Maple St., Three Rivers, Michigan.

ARMSTRONG *Inverted Bucket* STEAM TRAPS

Over a Million in Use... For Power... Process... Heating

SPECIFY OPEN STEEL FLOORING

for maximum light and ventilation!



Hendrick Mitco open steel flooring has rectangular openings that afford maximum light and ventilation —a 90% open area! Mitco performance and service life always measure up to expectations because Mitco's square edge bars are formed into an integral unit and provide a safe, non-slipping, level walking surface. It has no bolts, nuts or rivets to collect dirt and obstruct light. If you will send details of your area to be covered, indicating size, type and location of supports, Hendricks will prepare a Mitco recommendation.

HENDRICK

Manufacturing Company

Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Amorgrids.

46 DUNDAFF STREET, CARBONDALE, PENNA.

Sales Offices In Principal Cities

WHITLOCK

DEAERATING FEEDWATER HEATING SYSTEM

COMPACT • EFFICIENT

The Whitlock Deaerating Feedwater Heating System soon pays for itself by preventing the corrosion of boiler tubes, steam lines and auxiliary equipment: normal oxygen concentrations which very rapidly consume iron are reduced to the required minimum. The Whitlock system can be installed in a very limited space and its construction is simple, without complicated internal parts. High deaerating efficiency is maintained for years, with very little attention . . . the Whitlock name is your guarantee of durability and trouble-free performance.

Ask our engineers to analyze your requirements.

Write for Bulletin 645

THE WHITLOCK MANUFACTURING CO.

46 South St., Elmwood, Hartford 1, Conn.

New York Boston Chicago Philadelphia Detroit Richmond. In Canada: Darling Bros., Ltd., Montreal

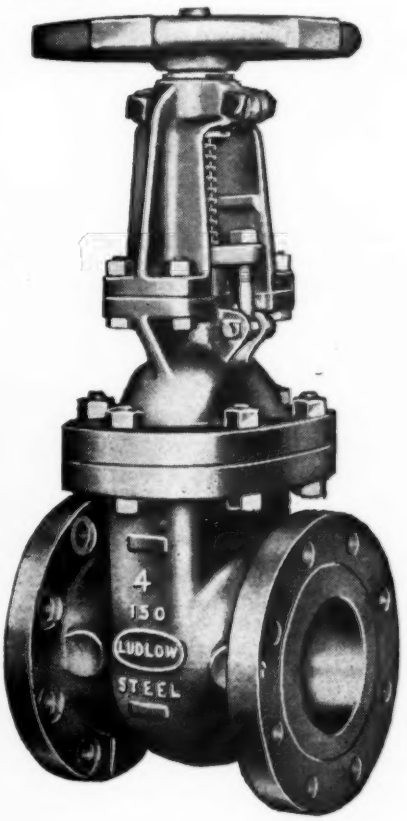
Established 1891 – Ahead of the times for half a century

MODERN

FROM HANDWHEEL TO FLANGE

No point of good engineering practice was overlooked in designing the Ludlow Cast Steel Wedge Gate Valve line. The sturdy lugged-rim handwheel which provides a slip-proof grip on the cool rim and the heavy split yoke to take the thrust, with the handy cast lugs for use as a follower shelf during repacking, are but two exterior examples of the superiority of this Ludlow design.

Write for complete Ludlow Valve Catalogs.



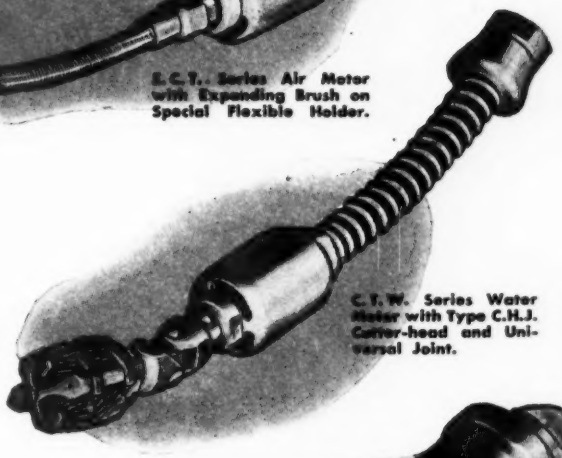
Ludlow Cast Steel Wedge Gate Valve. Now made in sizes 4" to 12", 150 lb. series only.

The LUDLOW VALVE MFG·CO·INC· SINCE 1866 TROY·N·Y·

There is a WILSON tube cleaner for every power plant need

C. Series Air or Steam Motor with Vibrating Head and Universal Joint.

E. C. T. Series Air Motor with Expanding Brush on Special Flexible Holder.



C. T. W. Series Water Motor with Type C.H.J. Cutter-head and Universal Joint.

C. T. Series Air or Steam Motor with Expanding Brush.

...and the "check list" tells all about them

No matter *what* the installation — fire or water-tube boilers, condensers, heat exchangers, oil heaters and coolers — there is a WILSON Tube Cleaner specifically designed to solve your tube cleaning problem — with speed that cuts down-time and allows more unit operating time.

Products of years of experience in tube cleaning processes, WILSON tube cleaners embody exclusive design features which make possible such speed and efficiency.

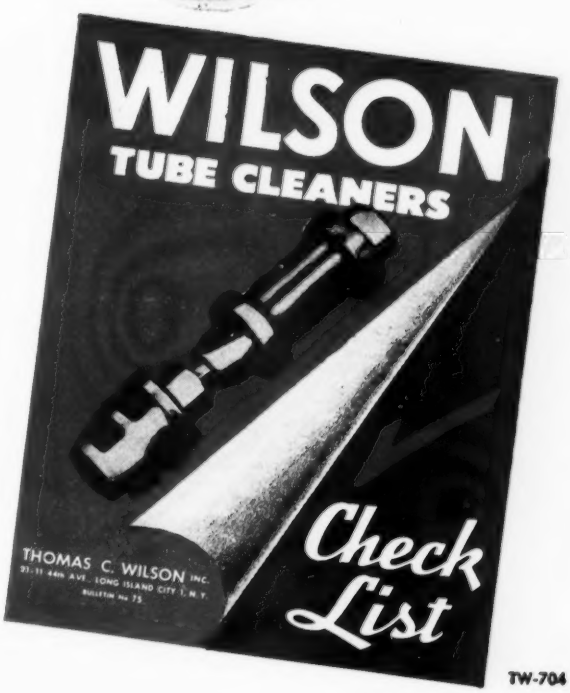
Like thousands of other engineers, you can obtain the same tube cleaner performance through use of the Wilson Tube Cleaner's Check-list (25,000 copies requested already). A glance at the booklet will show you how to determine quickly the correct choice of Wilson tube cleaning equipment (motor, cutter head, flexible shaft, or other accessory), so you will be assured of most efficient tube-cleaner performance.

In addition, this six-page booklet offers valuable hints on tube cleaner operation as well as maintenance "tips" which will insure against costly wear and tear of your tube cleaners — for longer life!

Engineers know that tube cleaning problems have a bad habit of cropping up when they're least expected. But you can be prepared if you have the Wilson Tube Cleaner's Check List within easy reach. So *write today* for your copy. It will prove to be a shrewd move. Please address department M.

THOMAS C. WILSON, INC.
21-11 44th Avenue, Long Island City 1, N. Y.

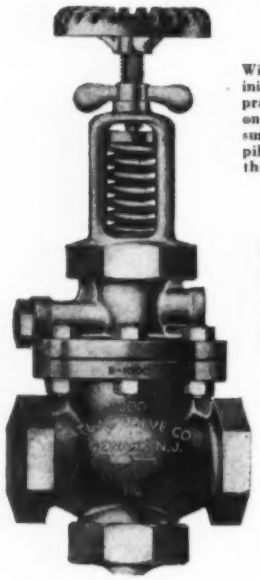
WILSON
TUBE CLEANERS



TW-704

ATLAS

"Type B" STEAM REDUCING VALVES



Wide fluctuations in initial pressure have practically no effect on the reduced pressure because of the pilot operation of this valve.

Write for Bulletin No. 1A giving complete details.

For 300 lb. Service

All Bronze—Screwed or Flanged Ends—Bronze or Nickel Alloy Seats and Valves—Pilot Operated. Sizes: ½", ¾", 1", 1¼", 1½", 2".

For 250 lb. Service

Iron Body—Flanged Ends—Bronze or Nickel Alloy Seats and Valves—Pilot Operated. Sizes: 2½", 3", 4", 5", 6", 8".

For 400 and 600 lb. with Temperatures to 900° F.

Series 40 for steam service to 400 lb.

Series 60 for steam service to 600 lb.

Steel Body—Monel Metal, Stainless Steel Nitralloy Seats—Stainless Steel Piston and Piston Chamber—Flanged Ends—Pilot Operated. Sizes: ½", ¾", 1", 1¼", 1½", 2", 3", 4", 6".

Principal ATLAS Products

On which do you want complete information? Check the items below and mail to us with your name, firm and address.

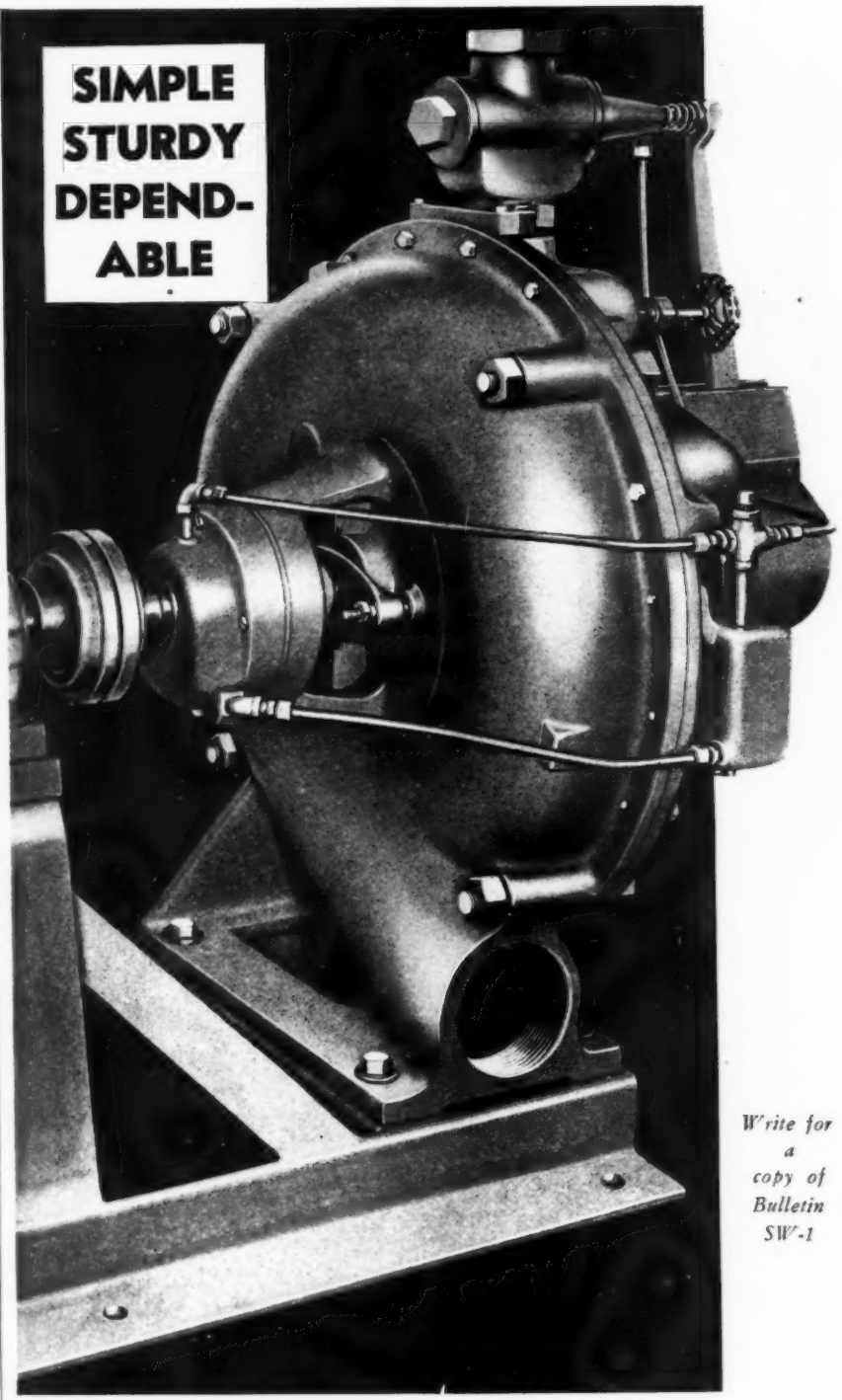
- ☐ Reducing Valves
- ☐ Damper Regulators
- ☐ Temperature Regulators
- ☐ Exhaust Control Systems
- ☐ CAMPBELL Boiler Feed Water Regulators
- ☐ Pump Governors
- ☐ Pressure Regulators
- ☐ Float Valves
- ☐ Oil Control Cocks
- ☐ Humidity Controllers
- ☐ Thermostats
- ☐ Balanced Valves
- ☐ Control Valves

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE

289 South Street **Newark 5, N. J.**

Representatives in Principal Cities

SIMPLE STURDY DEPEND-ABLE



Write for a copy of Bulletin SW-1

OPERATING RANGES OF WING TURBINES

	STANDARD	HIGH PRESSURE
Maximum B. H.P.	100	150
Maximum Steam Temp.	525° F	750° F
Maximum Pressure	275 lbs.	600 lbs.
Back Pressures, up to	50 lbs.	50 lbs.
Speeds, up to	4000 RPM	4000 RPM

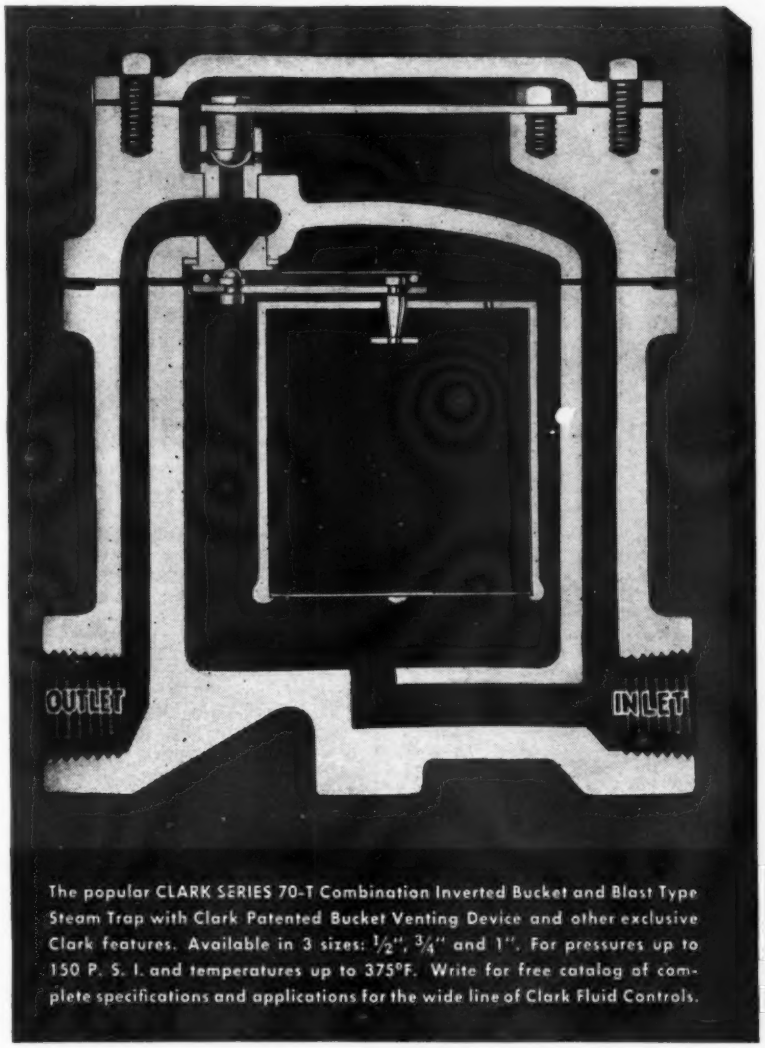
L. J. Wing Mfg. Co.,
151 W. 14th Street
New York 11, N. Y.

Factories: Newark, N. J. and Montreal, Canada

Wing

AUXILIARY STEAM TURBINES

Performance •



The popular CLARK SERIES 70-T Combination Inverted Bucket and Blast Type Steam Trap with Clark Patented Bucket Venting Device and other exclusive Clark features. Available in 3 sizes: ½", ¾" and 1". For pressures up to 150 P. S. I. and temperatures up to 375°F. Write for free catalog of complete specifications and applications for the wide line of Clark Fluid Controls.

Better performance and longer life for your equipment are the inevitable result of installing Clark Fluid Controls wherever steam, air or gas are used.

That is true now, and it has been true throughout the **37 Years** of Clark leadership in fluid control design and precision manufacturing!

Clark
FLUID CONTROLS

THE CLARK MANUFACTURING COMPANY • DEPT. A • CLEVELAND 14, OHIO

Makers of a wide line of fluid controls including

STEAM AND FLUID TRAPS	STRAINERS	PRESSURE REGULATORS
VACUUM AND LIFTING TRAPS	VALVES	REDUCING VALVES

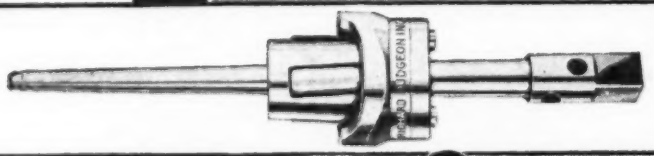
DUDGEON
TYPE 22

The new DUDGEON 22 series is a streamlined design, increased in ruggedness by simplified construction. The sturdy one-piece frame withstands heavy use without cracking or warping . . . assure life long rapid production in rolling tubes. A hardened guide ring bearing against the hardened surface of the frame provides longer life than the customary bronze bushing. This series expands a large range of tube gauge sizes, draws and sets the tubes automatically and gives smooth, rapid expansion and feed.

DUDGEON
HIGH EFFICIENCY
TUBE EXPANDERS

. . . Backed by a reputation for jobs well done!

Check the reputation of DUDGEON tools on the job—ask the man who uses them! Double check too, what we mean when we say "each tool is designed by and for men who know what good tools can do to cut costs and "up" job quality. Do this and you'll find that DUDGEON'S 97 years have been aggressively occupied in advancing designs, improving materials, and modernizing methods so that these expanders deliver maximum efficiency at the lowest possible cost.

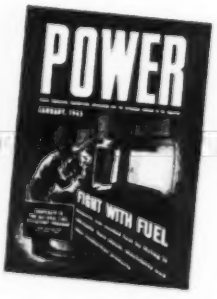


Complete literature on DUDGEON products — expanders, hydraulic pumps and jacks — available. Write Department

RICHARD *Dudgeon* INC.
MFRS. OF TUBE EXPANDERS SINCE 1853
24 COLUMBIA STREET, NEW YORK 2, N. Y.

To Get the Answers on Questions About . . . .

Mechanical Transmission	Electricity
Boilers & Heating	Oils and Lubrication
Pumps and Compressors	Refrigeration
Diesel and Gas Engines	Fuels and Furnaces
Steam Turbines, Condensers	Steam Engines
Valves, Piping and Fittings	Meters and Instruments



. . . READ REGULARLY

Covering the Generation, Transmission and Application of ALL the Power Services

330 WEST 42ND STREET • NEW YORK 18, N. Y.

Type DA-31 Pressure Control

MERCURY SWITCH
Hermetically sealed mercury switch is used. They cannot be affected by dust, dirt or corrosion; nor are they subject to open arcing, oxidation, pitting or sticking of contacts, all common causes of contact trouble. This switch will give better control service and longer control life.

BOURDON TUBE
(Hidden back of cover)
The Bourdon tube is the actuating element of the control. It is the oldest known, tried and proven element, having been used in gauges for many years.

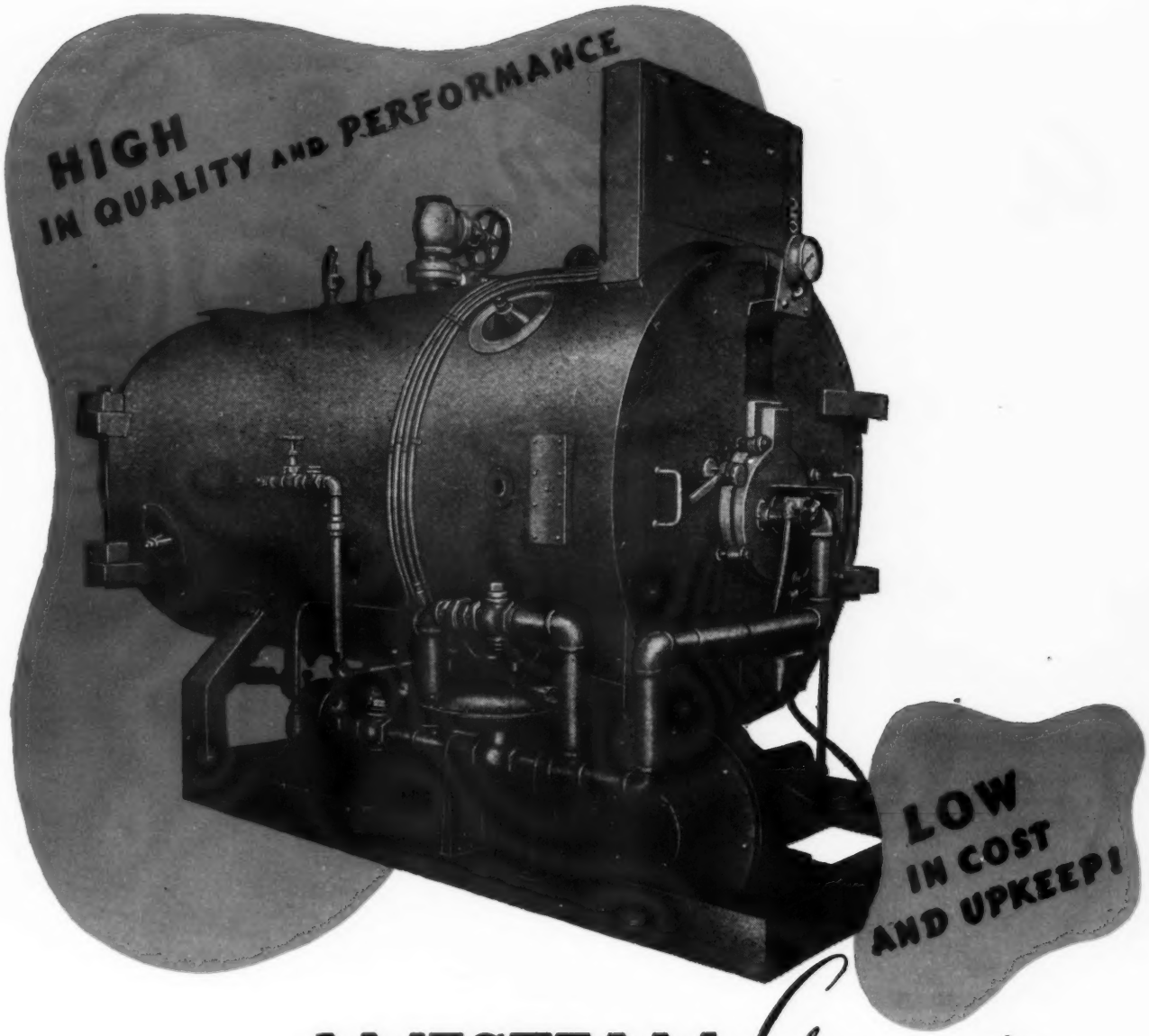
OUTSIDE ADJUSTMENT
The outside double adjustment with the calibrated dial and pointers is a convenient feature, making it very easy to set the required operating range, plainly visible on the dial. All guesswork is eliminated.

GLASS FACE
The glass face on the cover permits seeing the entire operation of the control in plain view. One can always tell whether the switch circuit is open or closed, a great convenience whenever servicing becomes necessary.

Consult Mercoid on pressure, temperature, liquid level or automatic mechanical control problems.

THE MERCOID CORPORATION
4201 Belmont Avenue
Chicago 41, Illinois

THE ASSURANCE OF DEPENDABLE SERVICE
BUILT IN EVERY
MERCOID CONTROL



AMESTEAM *Generator*

If you want *power* for a small or medium-sized plant, you want an AMESTEAM Generator. Because AMESTEAM delivers what every engineer wants in a steam generator!

Its original cost is low. Its installation and upkeep are low. Its manpower requirements are low. Yet when it comes to performance, it rates up at the top. It provides steam *rapidly*, cleanly . . . its operation is unaffected by draft conditions . . . and it does not need an expensive foundation or stack.

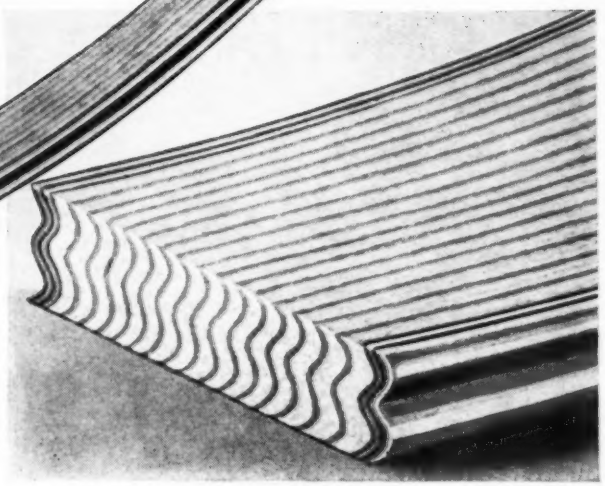
Reasons for these obvious advantages are the 100 years of Ames' experience and the perfection of design and manufacture. And they are also the reasons why you should call Ames if you want a power plant ranging from 10 to 300 horsepower!

A complete Return to the Boiler System, including Feed Water Pump and Condensate Tank with their accessories, is part of the standard equipment with every standard AMESTEAM Generator.

AMES IRON WORKS
BOX 84 OSWEGO, NEW YORK

a Better Gasket

RESILIENT—EXPANDS AND CONTRACTS WITH CHANGING TEMPERATURES



For a permanently tight joint under changing temperature conditions your gasket should be a GARLOCK *Guardian* gasket. This gasket combines extraordinary resiliency with great strength. Because of its unique structural design it adjusts itself instantly and repeatedly to expansion and contraction of the pipe line or equipment. Also *Guardian* gaskets withstand extreme temperatures and pressures and effectively resist the destructive action of gases and liquids.

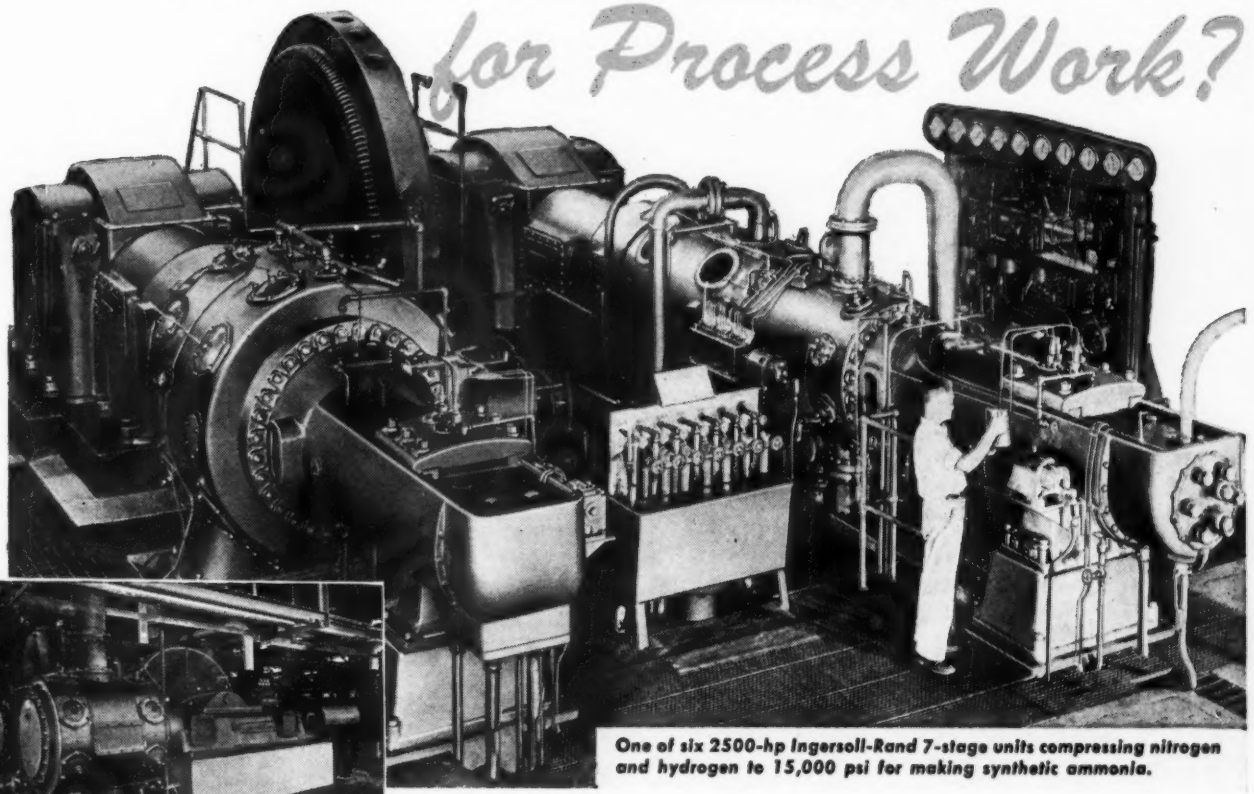
Cross section view of GARLOCK *Guardian* gasket shows three points of resiliency of the metal strips which separate the layers of asbestos. Inner and outer edges of the gasket are reinforced with double thicknesses of metal, electrically welded for added strength.

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

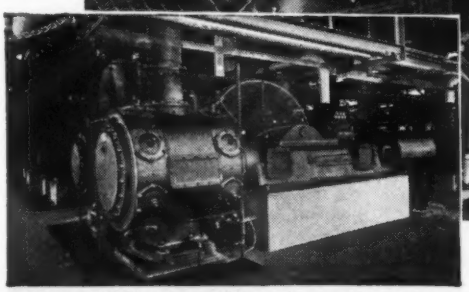
In Canada: The Garlock Packing Company of Canada Limited, Montreal, Que.

GARLOCK *Guardian* GASKET

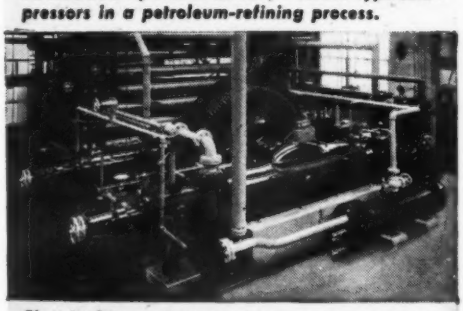
What assures a GOOD COMPRESSOR for Process Work?



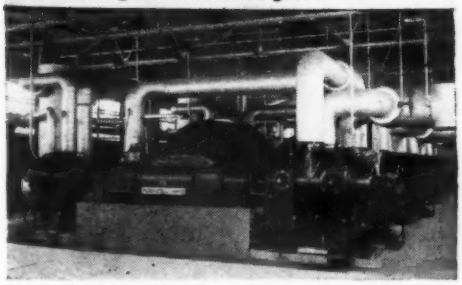
One of six 2500-hp Ingersoll-Rand 7-stage units compressing nitrogen and hydrogen to 15,000 psi for making synthetic ammonia.



Twelve 600-hp steam-driven, 4-corner-type compressors in a petroleum-refining process.



Electric-driven, 3-stage 4-corner-type compressor handling carbon-dioxide gas.



←Three electric-driven, 2-stage 4-corner-type, ammonia compressors used in a petroleum-refining process.

Here is what assures a good compressor for those processes where interruptions of the cycle may cause large losses in production, introduce conditions that may be dangerous or hazardous, or necessitate extensive repairs or replacements:

The compressor manufacturer must have sufficient knowledge to enable him to predict in advance what conditions in the process might cause a shut-down of the compressor . . . and then must be able to design and build the compressor so that any possibility of interruption of service is reduced to a minimum.

The only way to obtain such knowledge is through years of actual engineering experience in building and applying compressors for all kinds of processes . . . for handling all sorts of gases . . . and for any range of pressures.

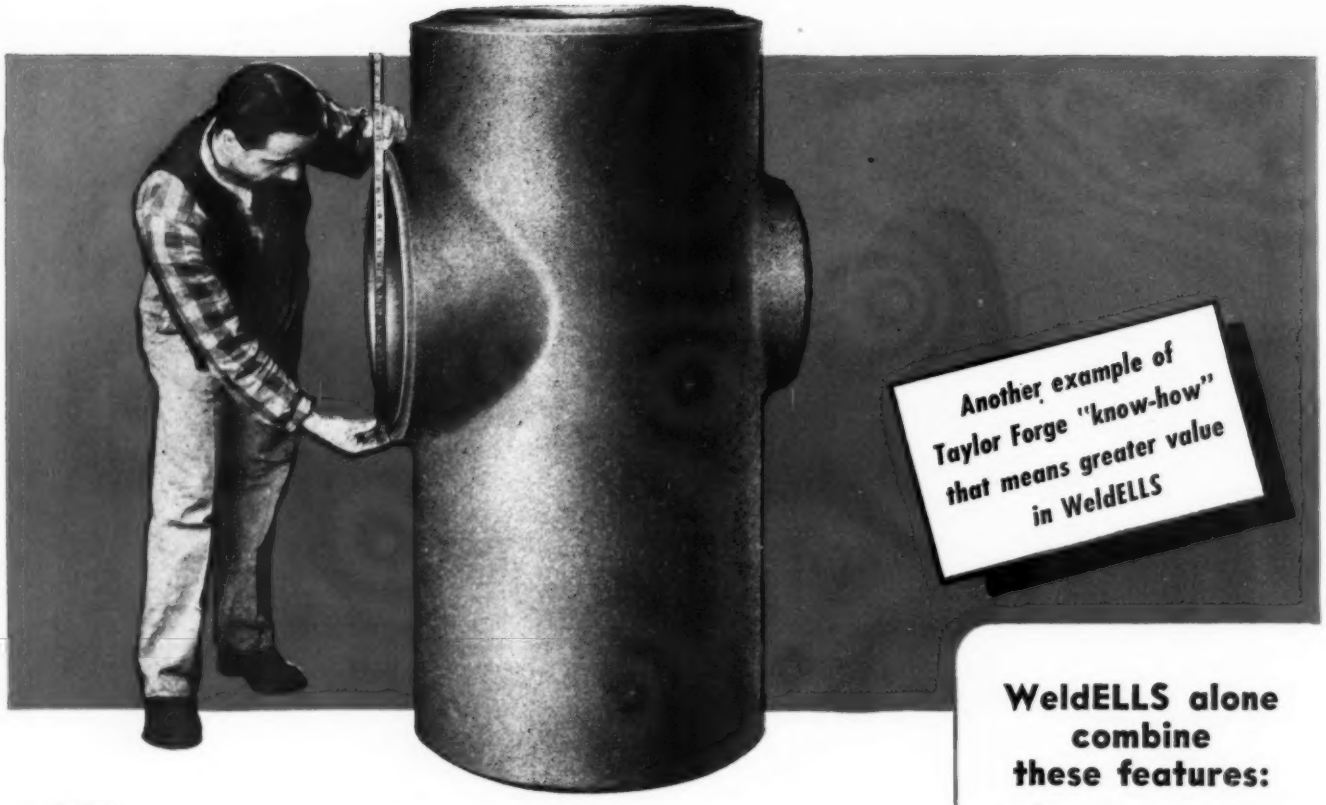
Ingersoll-Rand has that kind of experience, and can help you with your compressor problems.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

AIR TOOLS
COMPRESSORS
ROCK DRILLS
TURBO BLOWERS
CONDENSERS
CENTRIFUGAL PUMPS
OIL & GAS ENGINES

T-767



Tough ones for TAYLOR FORGE *mean good ones for you*

In anybody's language this is SOME Welding Fitting . . . a cross nearly five feet long (forged from 2-5/16" thick seamless carbon moly tubing) 22" I.D. in the run with 20" I.D. and 14" I.D. outlets forged integrally to close tolerances. We made a number of fittings like this to replace another type that had begun to show signs of failure under severe service in an important oil refinery job. It was a difficult and exacting job—in this respect only typical of many others that are turned over to us almost daily!

As a user of Welding Fittings in standard sizes and types, what does it matter to you that Taylor Forge is almost continually doing things with hot metal that nobody else does? Only this:—

It is the specialized "know-how" accumulated through years of experience in handling the unusual jobs that enables us to make Taylor Forge Welding Fittings *exactly* as they should be made . . . to incorporate in them the soundest engineering principles . . . to give them features that bring extra value to users.

WeldELLS provide an outstanding example of this specialized skill and knowledge. Consider such features as the selective reinforcement that provides uniform strength, the tangents which keep the weld away from the most highly stressed zone, the accurately sized ends and extreme accuracy of all other dimensions. Consider, in fact, all of the features listed opposite and we believe you will agree that

WeldELLS have everything

WeldELLS alone combine these features:

- **Seamless**—greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength.
- **Permanent and complete identification marking** — saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends** — provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World**—insures complete service and undivided responsibility.

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P.O. Box 485
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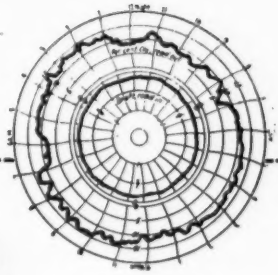
UNIFORM COAL SIZING REDUCES...

RAGGED FIRING

EXCESSIVE CO_2



ASHPIT LOSS

AMERICAN

Rolling Ring

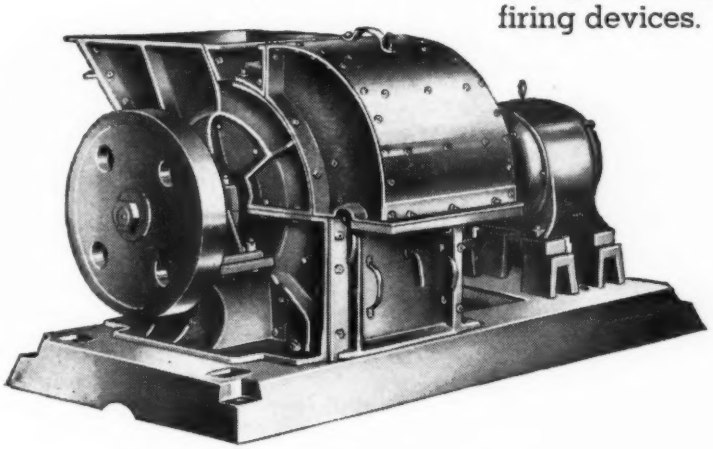
CRUSHER

•

Ragged firing — with alternately excess air and insufficient air . . . excessive CO^2 instead of uniform combustion . . . excessive ash pit drops — are all costly and inefficient results of coal not uniformly sized.

Coal, even poor grades, is *uniformly* reduced by American Rolling Ring Crushers for improved firing efficiency and for lower cost of handling. Control of fines and no oversize provides for uniform, high combustion.

Complete handling of refuse and positive rejection of tramp iron safeguards against damage to mechanical firing devices.



The efficiency and low 1c-per-ton-operating-cost, of American Rolling Ring Crushers results from full use of centrifugal force — the revolving rotor plus the patented free revolving shredder rings. The shredder rings revolve free on their own shafts — each with 20 cutting teeth that split coal instead of crushing it. They deflect from tramp iron.

Write for your copy of "*Crushing Coal At Less Than 1c per Ton*"

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

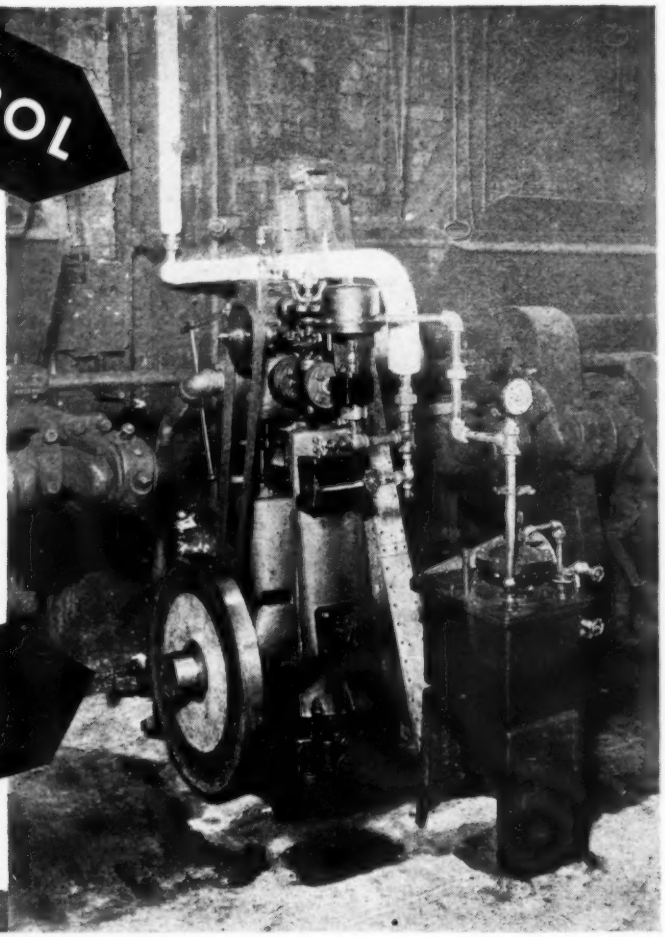
1349 Macklind Ave.
St. Louis 10, Mo.

TROY-ENGBERG STEAM ENGINE

CLOSE SPEED CONTROL

IS THIS WHAT *You* WANT?

WIDE SPEED RANGE



The steam engine can idle along or can turn over at top rated speed which is many times the speed of idling or it can be set at any intermediate speed.

This is one reason why you will find Troy Steam Engines on so many stokers, particularly those with widely varying boiler loads. And this same flexibility coupled with close speed control makes the steam engine very useful for driving other equipment which operates with variable speeds. Industry has plenty of such installations . . . and plenty of use for the modern Steam Engine.

Are you planning to purchase any equipment that requires a drive? Do you have some drives that should be changed? If so, we suggest you investigate the Troy-Engberg Engine.

TROY ENGINE & MACHINE COMPANY
Established 1870
2514 Railroad Avenue Troy, Pennsylvania

TROY-ENGBERG
STEAM ENGINES • GENERATING SETS • GENERATORS

Unless your Damper has all these features

IT ISN'T A HEACON

A ***A damper that is tight.*** Flexible curtain conforms and actually *seals.* Banking losses and bypass leakage are eliminated.

B ***A damper that gives you absolute flow control.*** The Heacon area characteristic is a straight line. With a constant differential, the flow characteristic is a straight line, making stable automatic combustion possible over ranges of 10—1.

C ***A damper that is completely removed from the path of flow when fully opened.***

D ***A damper with a shaft that will not warp.*** Shafts and bearings are entirely removed from the path of flow and can therefore be generous in size to avoid warping.

E ***A damper without torque.*** Since the flow pressure is taken by the grill and frame, torque is not transmitted to the operating shaft. This makes accurate control possible.

F ***A damper operating in a minimum of space.*** The Heacon Damper operates vertically within the confines of its frame. This permits installations to be made where only a very small space is available. It also permits the design of new equipment with a minimum of clearance allowed for the damper.

The Heacon Damper gives you all these advantages and many more. Throughout, it is designed to eliminate the undesirable factors inherent in conventional dampers and to make full use of automatic control.

Write for Heacon Damper Catalog No. 10 and call our nearest field engineer for a damper engineering recommendation.

HEACON GIVES CONTROLLED FLOW

1. MORE RELIABLE OPERATION
2. INCREASED CAPACITY
3. REDUCED MAINTENANCE
4. GREATER FLEXIBILITY
5. HIGHER EFFICIENCY
6. BETTER REGULATION
7. LOWER BANKING LOSSES
8. QUICKER STARTING
9. SAFER OPERATION
10. CLEARANCE WITHOUT LEAKAGE

HEACON INC DAMPERS

THERMIX ENGINEERING COMPANY

Project and Sales Engineers

FIRST NATIONAL BANK BLDG., GREENWICH, CONN.

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WASHINGTON, D. C.
T. W. McGuire Co.
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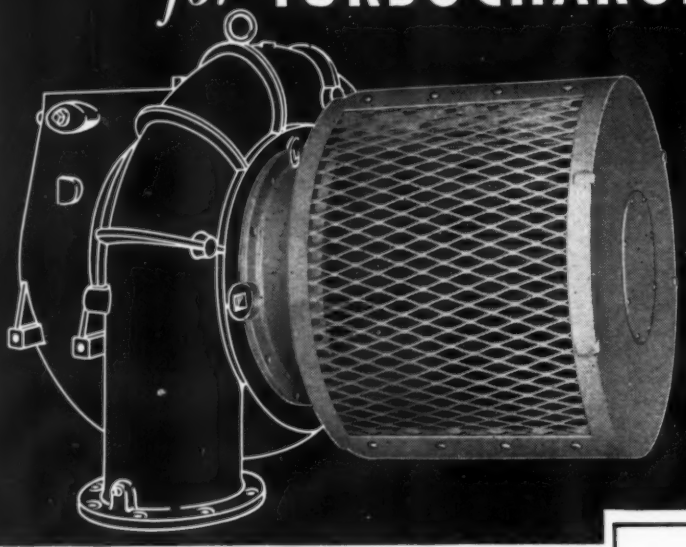
New Air-Maze Filter-Silencer Engineered *for* TURBOCHARGED DIESELS!



★ INSURES EFFICIENT FILTRATION

★ EFFECTIVELY SILENCES INTAKE AIR

★ OPERATES AT ALL SPEED RANGES

AIR-MAZE TYPE E FILTER-SILENCER OFFERS 4 ADVANTAGES!

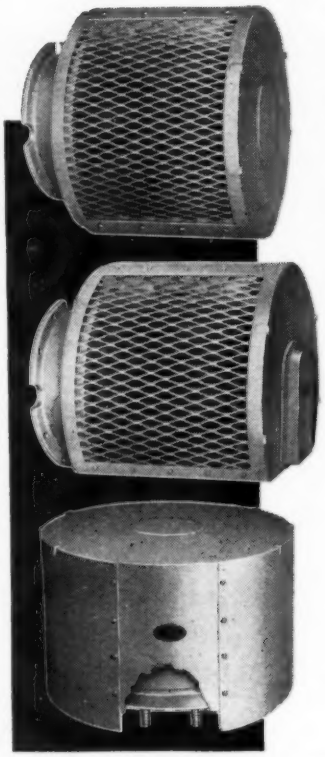
- Permanent, cleanable, all-metal filter element of scientific design.
- Uniform density at all times—element cannot pack down or separate from vibration.
- Combined filtering *plus* effective silencing.
- Minimum pressure drop.

Typical of the more than 3000 types and sizes of filters engineered by Air-Maze during the past 20 years—the Type E is a *specific* problem solved by *application engineering* and *research*. Let our engineers work with you in the solution of your particular filtration problem.

AIR-MAZE CORPORATION • CLEVELAND 5, OHIO

Representatives in principal cities. In Canada: Williams & Wilson, Ltd., Montreal, Quebec, Toronto, Windsor; Fleck Bros., Ltd., Vancouver, B. C.

3 Models Available



ENGINE LUBRICATED

Direct-mounted model designed with oil connections to turbocharger when lubricated by engine lubricating system.

TANK LUBRICATED

Direct-mounted model where turbocharger is independently lubricated by its own tank. Special pipe connections are furnished.

REMOTE MOUNTED

For installation at a remote point from the engine such as outside the engine cab or building.

IF IT USES AIR . . . USE

AIR-MAZE

ENGINEERED AIR FILTRATION

• Oil bath type filters and filter-silencers • Cleanable filter panels for air-borne dirt, oil, grease and liquids • Oil-wetted type filters and filter-silencers • Exhaust spark arresters • Gear case, crankcase and tank vent breathers • Oil-separators for engine crankcases • Full-flow type cleanable oil filters

Send for this New Catalog!

Special new catalog gives you complete information on all three models, including specification table and technical data designed for quick, ready reference. Send for yours today. Ask for Catalog No. EFS-246.

RUBBER PLANTATION — AMERICAN STYLE

The only three butyl rubber plants in existence . . . those at Baton Rouge, Louisiana; Baytown, Texas; and Sarnia, Ontario . . . were engineered and built by Stone & Webster Engineering Corporation. In view of the many specialists required for each plant's design, erection and ultimate operation, we also acted as the coordinating agency.

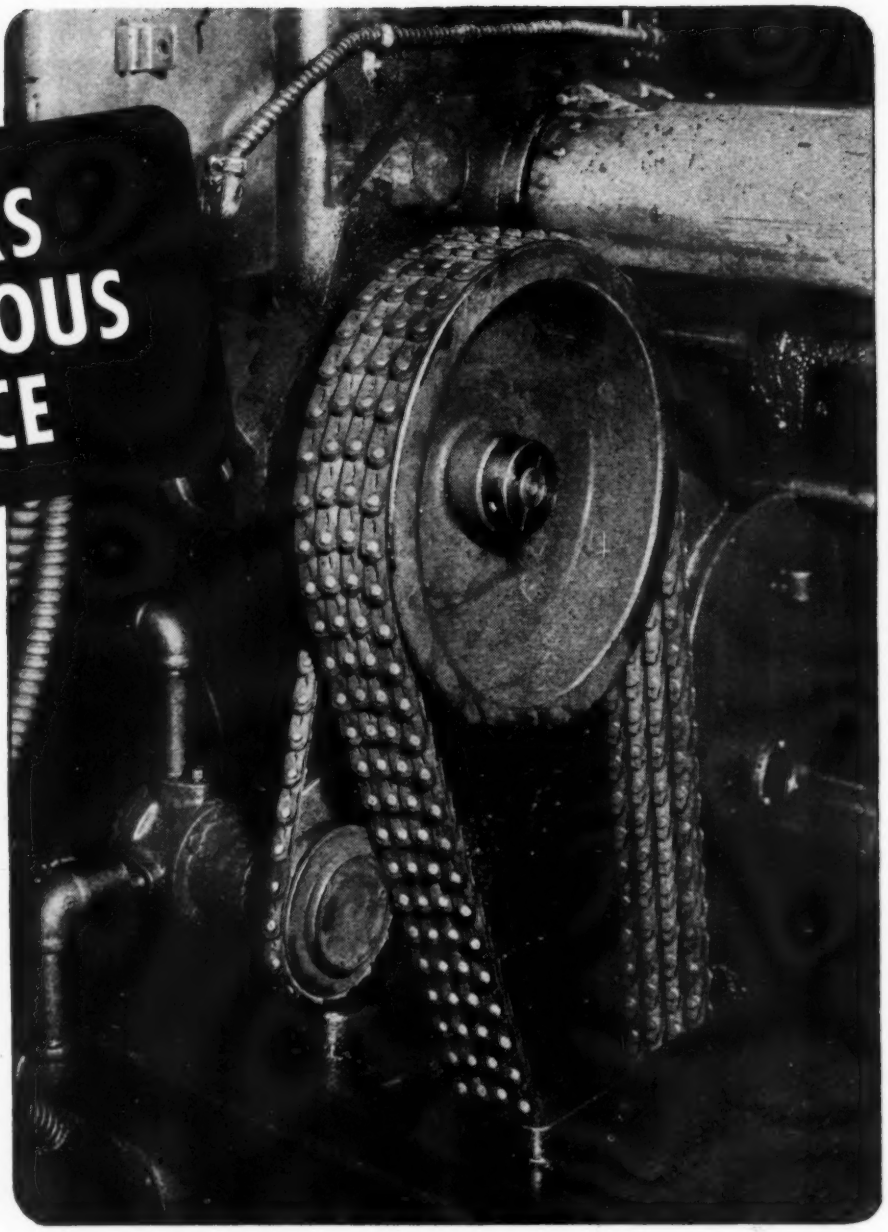
Pictured above, unit #2, butyl rubber plant, Baton Rouge, Louisiana, operated by Standard Oil of New Jersey (Louisiana Division). Largest and first to go into operation; design capacity is 33,000 long tons of butyl rubber per year.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

2 YEARS CONTINUOUS SERVICE

without 1 Adjustment



Two Veelos V-belt drives on No. 5 Gisholt Lathe. 4 Veelos "B" belts operate the main drive; 1 Veelos "B" belt operates the oil pump.

ON FEBRUARY 3, 1944, five Veelos V-belts were installed on this No. 5 Gisholt Lathe—located in a large steel plant. They have been in continuous operation ever since—*under severe conditions. Yet these belts have never once been adjusted and are reported remarkably free from slip.* Idlers used on the former belt installation were removed when Veelos went on.

On all V-belt drives that call for uniform belt tension without difficult adjustment and for freedom from slip, link construction makes Veelos the logical choice because:

Link Construction Maintains Uniform Tension

Easy adjustment of Veelos length assures that each strand of a multiple V-drive carries its exact share of the load. All strands constantly work together, *delivering full power.*

Link Construction Ends Slip

Veelos link construction provides quick, easy tension adjustment to end slip . . . keeps machinery running at full speed and productivity.

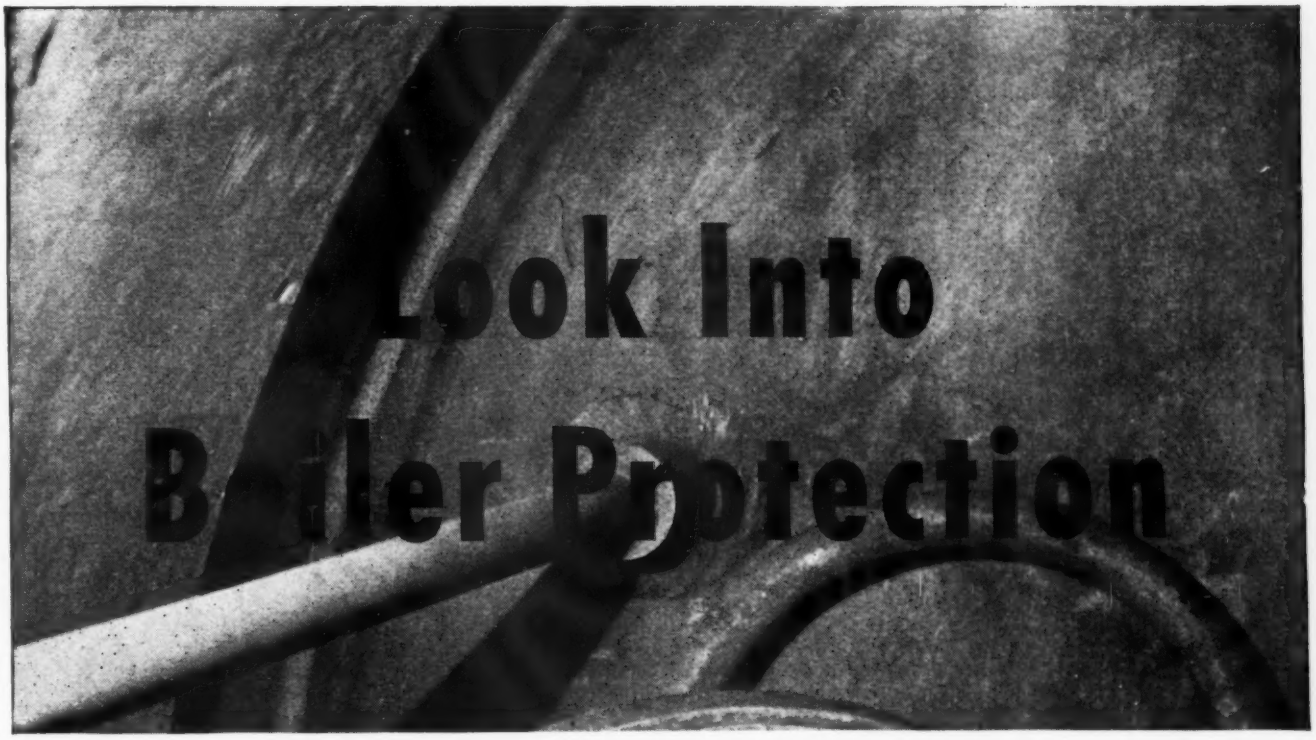
Let us give you the Veelos record on other drives—covering a broad range of applications and industries. Write today.

MANHEIM MANUFACTURING & BELTING CO.
MANHEIM, PENNSYLVANIA

VEELOS
THE LINK
V-BELT

Adjustable to any Length
Adaptable to any Drive

LINK CONSTRUCTION UPS PRODUCTION



This high pressure boiler interior has been coated with APEXIOR NUMBER 1. The photograph, taken after more than five years of service, shows that no water or steam has touched the boiler metal.

A thin, brush-applied film of APEXIOR NUMBER 1 provides positive, long-lasting protection for boiler interiors. Seeping into pores and joints, it seals off the metal surface from water and steam, effectively checking corrosion and embrittlement.

Corrosion may remain unknown and unchecked if left hidden under operating deposits. APEXIOR NUMBER 1, providing a wholly mechanical barrier, eliminates the tight chemical bonding of such deposits. Therefore, boiler maintenance is simplified — because the metal surface remains cleaner over longer periods, while its true condition is always apparent.

The tough, durable film of APEXIOR NUMBER 1, a few thousandths of an inch thick, does not retard heat transfer. On the contrary, by retarding heat-insulating layers of corrosion and sludge, it prolongs the period of high heat-transfer efficiency.

APEXIOR NUMBER 1 is applied to steam turbine shafts and rotor bodies at the factory, or during periodic inspections. It is equally effective on feedwater heaters and deaerators, Diesel engine removable liners, pump shafts and casings for high temperature boiler feed pumps, etc. Recommended by all U. S. and Canadian boiler insurance companies.

APEXIOR NUMBER 3 — A Companion Product for "Cold-Wet" Metal

Tanks, condensers, pumps, air washers, the submerged external areas of ships' hulls — all metal surfaces exposed to either fresh or salt water at temperatures up to 125°F. are given lasting protection with APEXIOR NUMBER 3. Tank applications are effective for every type of cold water supply, including drinking water.

Send the coupon below for free bulletin 1290, containing full information on APEXIOR brush-applied protective coatings.

Two new high-temperature Dampney coatings are Thur-Ma-Lox Number 7 Black (1600°F.) and Thur-Ma-Lox Number 10 Aluminum (1200°F.). Properly applied, they provide lasting protection to dry metal surfaces subjected to the extreme temperatures indicated.

Representative long-term users of APEXIOR:

Cunard White Star, Ltd.
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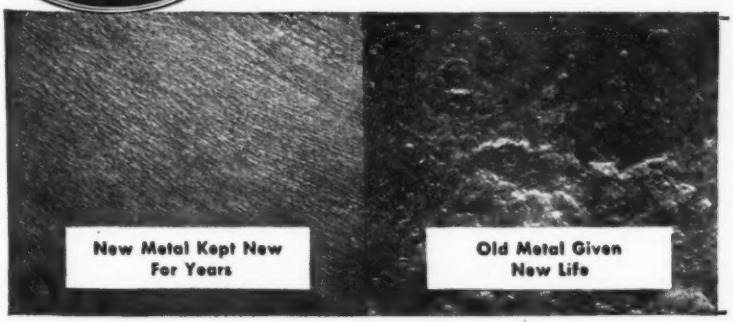
Youngstown Sheet & Tube Co.
Board of Education, Salt Lake City
Port Houston Iron Works
Interlaken Mills
Jones & Laughlin Steel Corp.

APEXIOR — *Keeps new metal new . . . Gives old metal new life* — DAMPNEY



THE DAMPNEY COMPANY OF AMERICA
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STOP GASKET TROUBLES ONCE AND FOR ALL!

EXTRA METAL REINFORCEMENTS

Exclusive Flexitallic "tailor-made" construction uses metal-to-metal reinforcing windings where and as needed throughout the spiral, one of many Flexitallic patented features. This provides maximum gasket strength and resiliency with a minimum of seating area.

The Answer to 1001 Gasket Problems

POSITIVE HIGH-PRESSURE INTERLOCK

Positive in its interlocking action, the Flexitallic design provides adequate resiliency for automatic adjustment of the gasket to meet changing line conditions.

Install Flexitallic Gaskets—and forget them! They're easier to install. They require no painstaking hand-finishing of seating surfaces. They automatically compensate for changing line conditions even under the highest of modern pressures and temperatures and the most severe conditions of use.

At the close of the war, more than 75% of all combat craft and a high percentage of all maritime vessels were Flexitallic equipped—convincing evidence of their dependability and uniformly precise construction. Write for catalog. Better yet, send details of your application for specific gasket recommendations by Flexitallic engineers.

"Flexitallic"

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FLEXITALLIC GASKET COMPANY

8th & BAILEY STREETS · CAMDEN, N. J.

CUSTOM BUILT FOR ANY PRESSURE—ANY TEMPERATURE

ESS—ORIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—ORIGINAT

BURGESS SNUBBER BULLETIN for Diesel Exhaust Noise Control

MANOMETER READINGS ON EXHAUST MISLEADING

Mean effective pressure in an engine cylinder, as commonly measured in studying engine performance, has a specific meaning which is directly related to horsepower output of the engine. Mean pressure in an exhaust manifold, on the other hand, cannot be interpreted in terms of engine performance. This indicated pressure will vary at different points in the exhaust manifold, depending on manifold design. In addition, such pressures, as indicated by a U-tube manometer, have little relation to existing pressures at any instant. Such an instrument actually reads only a meaningless average.

The pressure-time curves at the right show actual pressure variations in the exhaust manifold, measured opposite each of four exhaust ports of an engine. Each curve covers only the time during which the exhaust port is open, this being the period when manifold pressures affect scavenging. The misleading average "manometer indicated" pressure for the exhaust of the cylinder in question is shown by the broken line on each pressure curve.

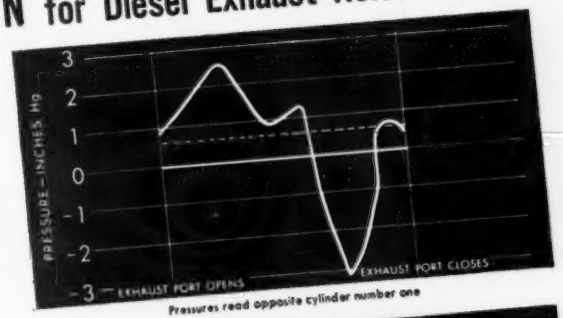
During this test a U-tube manometer indicated eight inches H_2O gauge pressure at the closed end of the exhaust manifold, not an excessive amount.

An analysis of the curve for cylinder No. 1 makes it obvious that the cylinder exhausts into a rapidly falling manifold pressure. The cylinder is quickly over-scavenged with a probable reduction in volumetric efficiency.

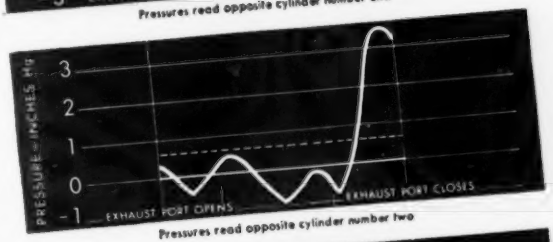
Curve No. 2 shows that the No. 2 cylinder exhausts into a relatively low pressure condition, and that exhaust gas is then rammed back through the exhaust port by increasing pressure to be trapped in the cylinder as the port closes. There is an abrupt rise of more than four inches Hg just before the port closes.

Curve No. 3 indicates scavenging early in the cycle, with burned gas being rammed back into the cylinder during the last 60 degrees of crank angle, which constitutes most of the exhaust cycle.

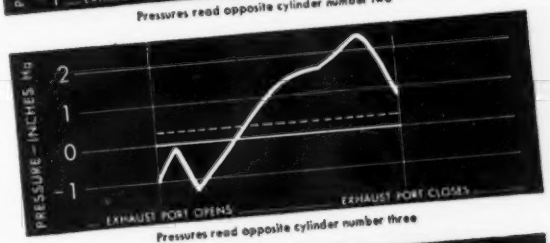
Curve No. 4 shows a good scavenging condition. There is no indication of unduly low manifold pressure or of "blow back" into the cylinder.



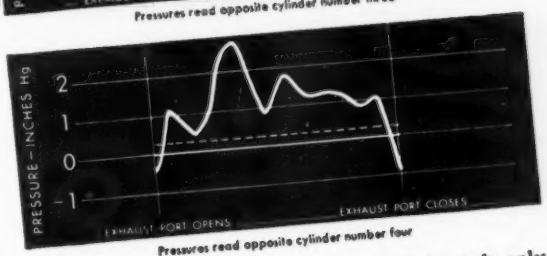
Pressures read opposite cylinder number one



Pressures read opposite cylinder number two



Pressures read opposite cylinder number three



Pressures read opposite cylinder number four

Obviously, the U-tube manometer, which reads only a uniform pressure, does not show what really happens to gases in the exhaust manifold. A future article will tell how true pressures are studied to solve exhaust back pressure problems.

★ ★ ★

NEW TOWBOAT WITH *QUIET* EXHAUST

The "George T. Horton," newest towboat and largest ever built in the Chicago area, has just started service on the Mississippi. It will push the equivalent of the lading of two hundred freight cars. Exhaust roar from its two heavy-duty supercharged Superior engines is prevented by Burgess Exhaust Snubbers, which eliminate noise that would otherwise be intolerable.

On water or on land, Diesel engines are more widely used every day, in applications which must be quiet. Burgess Exhaust and Intake Snubbers are used in many critical locations because they *prevent* noise rather than simply muffle it.

Published by BURGESS-MANNING COMPANY Chicago, Illinois

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GESS—ORIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—ORIGINA

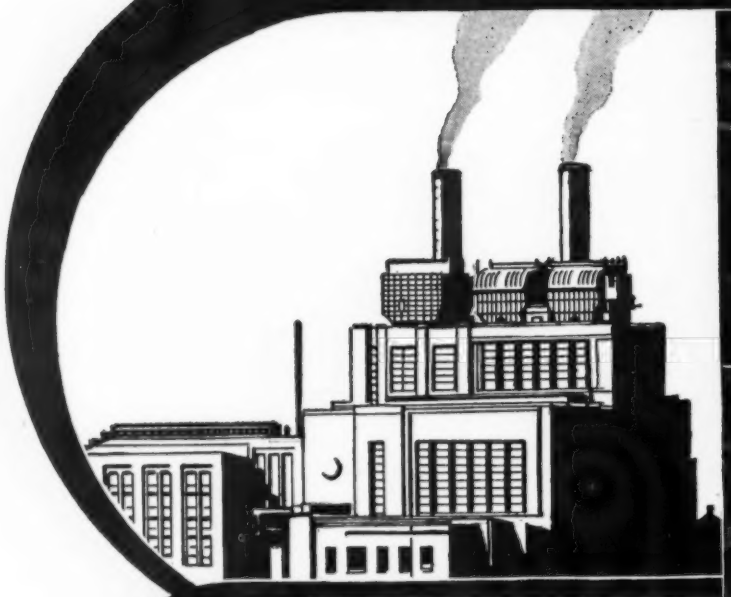
COMPLETE SATISFACTION IN EXHAUST AND INTAKE QUIETING—SPECIFY BURGESS SNUBBERS—FOR COM

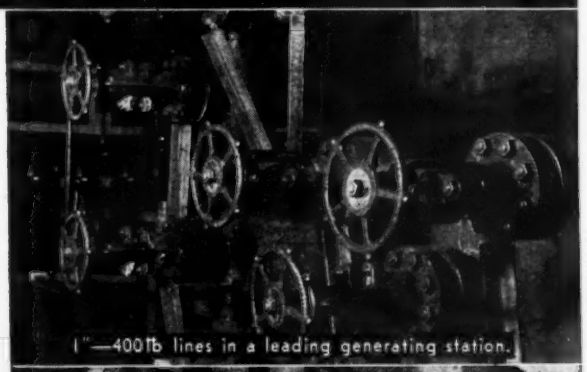
SPECIFY Vogt

DROP FORGED STEEL
VALVES, FITTINGS & FLANGES

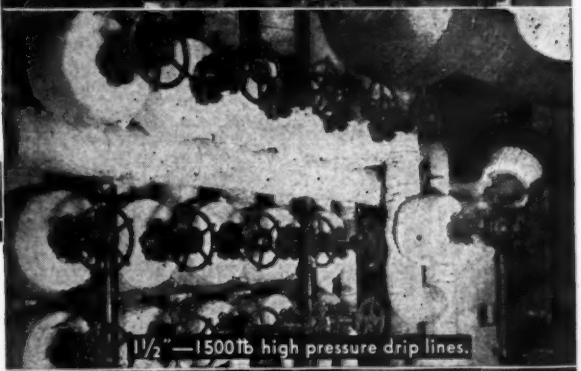
FOR

STEAM GENERATING PLANTS

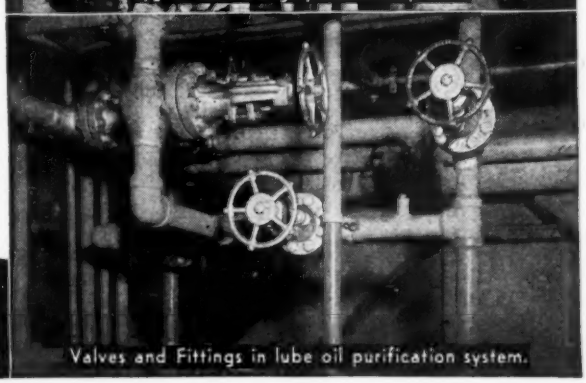




1"—400 lb lines in a leading generating station.



1½"—1500 lb high pressure drip lines.



Valves and Fittings in lube oil purification system.

SAFE and SURE control of vapors and liquids at high pressures and high temperatures in modern steam generating plants is dependent on piping materials having an inherent "plus" of strength and toughness. *Drop forged steel* Valves, Fittings, and Flanges made by Vogt play a vital part in the smooth, efficient operations of leading power plants.

Catalog F-8 is the drop forged steel Valves and Fittings Blue Book.

HENRY VOGT MACHINE CO., INC.
LOUISVILLE 10, KY.
Branch Offices: New York • Philadelphia • Cleveland • Chicago • Dallas

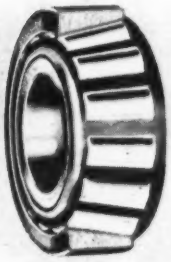
ROTO
TUBE CLEANERS
for UNION BOILERS

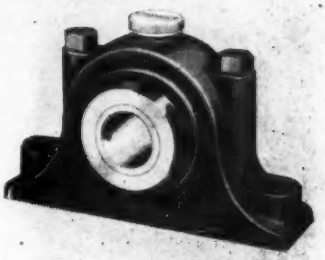
The Roto equipment illustrated will clean all the tubes in the many different designs of Union Iron Works Bent Tube and Straight Tube Boilers ranging in capacity from 20,000 to 120,000 lbs steam per hour. Roto Tube Cleaners for these and other type boilers are stocked ready for instant shipment. Engineering assistance on special tube cleaning problems gladly furnished. Write, wire or phone us your requirements.

Roto Model 125 Air-driven Motor with No. 350-I four-arm head and six-way drill for cleaning 3" curved tubes.

ROTO Division of ELLIOTT COMPANY
145 SUSSEX AVENUE - - - NEWARK 1, N. J.

DODGE PUTS TIMKEN BEARING PRECISION INTO WORKING CLOTHES





Delivered fully assembled, adjusted, lubricated, the Dodge-Timken Double Interlock Pillow Block is ready to lock on the shaft, run at full speed and full load. Dodge mounts, seals and houses the bearing assembly, with its double row of precision-finished rollers—makes it available for immediate service, with no assembling required on the job.

From our foundry, through many precision operations, on the latest machine tool equipment, the parts required for mounting this bearing are manufactured complete in the Dodge factory. This is one of the famous Dodge 30,000 hour line, covering a wide range of industrial bearing requirements, and promptly available from distributors' stocks.

Look for the Dodge distributor in your classified telephone directory under "Power Transmission Equipment."

DODGE MANUFACTURING CORPORATION, MISHAWAKA, INDIANA

Dodge-Timken Double-Interlock Bearing

LUBRICATION COVER CAP KEEPS DIRT OUT
STURDY, SELF-ALIGNING OUTER HOUSING
INNER HOUSING SELF-ALIGNS WITH SHAFT
NON-RUBBING INDESTRUCTIBLE LABYRINTH SEALS
SNAP RING AND SHIMS MAINTAIN CORRECT BEARING ADJUSTMENT
SET SCREWS LOCK BOTH ENDS OF RACE TO SHAFT
BEARING DELIVERED COMPLETELY ASSEMBLED, ADJUSTED, LUBRICATED—READY TO SLIP ON SHAFT AND GO TO WORK.

THE SYMBOL THAT CAME TO LIFE

257 factory graduate Transmissioneers wear this sign of a nation-wide personal service that provides the latest answers to power transmission problems.

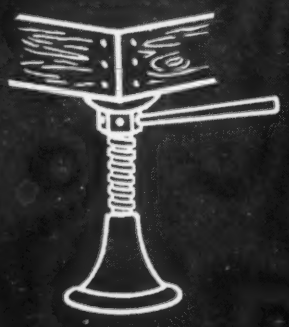
DODGE
MISHAWAKA

Copyright, 1946, Dodge Mfg. Corp.

NAME PLATES

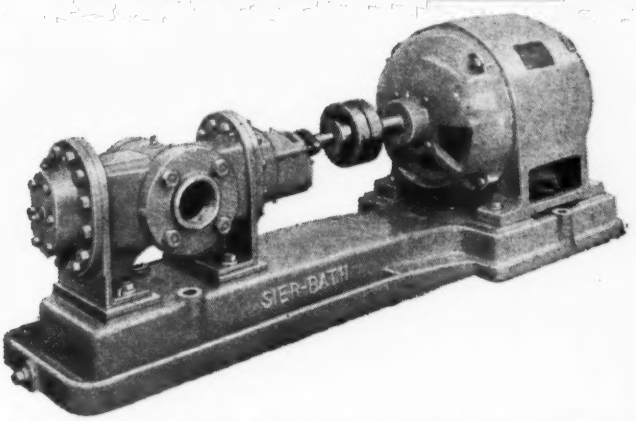
FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

for Lifting Houses



...the Jack Screw

TO PUMP THICK FLUIDS



...NOTHING BEATS THE THRUST OF A SCREW

For Pumping Asphalt, Acetate, Brines, Bunker C Fuel Oil, Cellulosics, Greases, Molasses, Syrups

Sier-Bath Screw Pumps

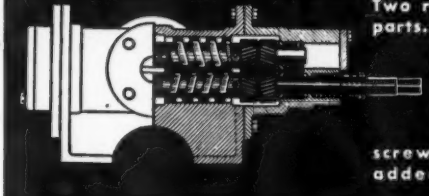
Lifting houses, propelling ships, the big jobs are done by screws. In pumping thick fluids, the screw's tremendous torque is applied by Sier-Bath Screw Pumps. Handling fluids of higher viscosity than conventional displacement pumps, they start more quickly on cold days and reduce fluid heating costs. In oil burner service, their pulseless discharge prevents "puffy" firing and reduces tip cleaning. Thus, it improves boiler efficiency. Where automatic operation is used, they do not cause "hunting" or overcontrolling.

Smooth and quiet in operation, Sier-Bath Screw Pumps are high in efficiency, low in maintenance and less affected by head. Even when slanted, they maintain constant flow. Sier-Bath Screw Pumps require no heavy foundations—an advantage in marine or temporary installations. Sier-Bath Screw Pumps are built to close tolerances. Removable liners may be specified. *Every Sier-Bath Screw Pump incorporates needle bearings because Sier-Bath pioneered in the use of needle bearings as standard equipment in screw pumps.* Write for bulletin.

Made by the manufacturers of Sier-Bath Precision Gears.

SIER-BATH GEAR COMPANY, Inc.
9254 HUDSON BOULEVARD • NORTH BERGEN, N. J.

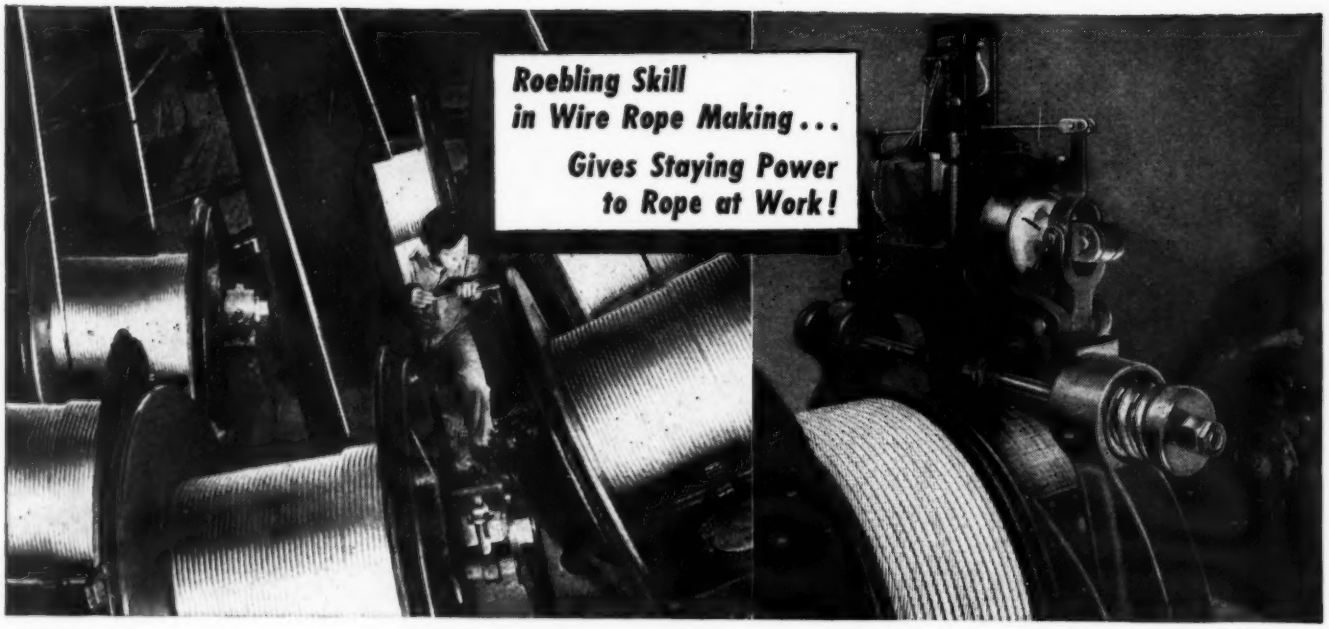
Only Two Moving Parts
MEANS LOW MAINTENANCE



Two rotors are the only moving parts. End to center fluid movement eliminates thrust bearings in horizontally mounted units. Self-centering timing gears prevent sidewear resulting from screw contact. Packing can be added while pump is running.

WIRE ROPE THAT

Saves While it Serves!



ELEVATOR SERVICE must be smooth, uninterrupted, *safe* . . . day in and day out. Costly shutdowns must be eliminated.

To get this service, elevator cables have to be *right*. And that means Roebling's *tough* "Special Traction Steel" Elevator Rope. Its proven ability to deliver long service . . . its strength and flexibility . . . make it the *safe* and *economical* choice for your elevators.

America's first wire rope makers—specialists in wire rope for over a century—have the product, skill and experience to help you get *maximum savings* from your elevator equipment. Roebling engineers will be glad to show you how.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouse in Principal Cities

WIRE ROPE AND STRAND • FITTINGS • SLINGS • SUSPENSION BRIDGES AND CABLES
COLD ROLLED STRIP • HIGH AND LOW CARBON ACID AND BASIC OPEN HEARTH STEELS
AIRCORD, SWAGED TERMINALS AND ASSEMBLIES • AERIAL WIRE ROPE SYSTEMS • ROUND AND SHAPED WIRE • ELECTRICAL WIRES AND CABLES • WIRE CLOTH AND NETTING

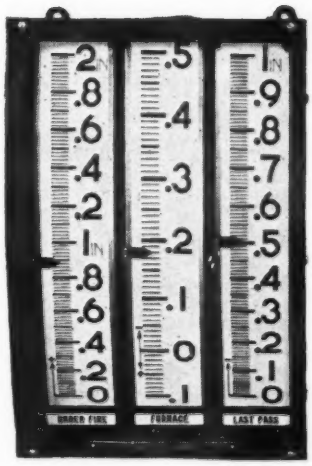
ROEBLING

PACEMAKER IN WIRE PRODUCTS

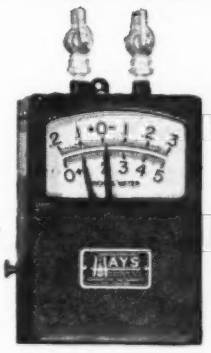
DRAFT GAGES in PRACTICAL, *Convenient and* ECONOMICAL SIZES

Series FOT
size
14" x 12"

Series D
size
12¼" x 9½"



Series V
size
12½" x 7"

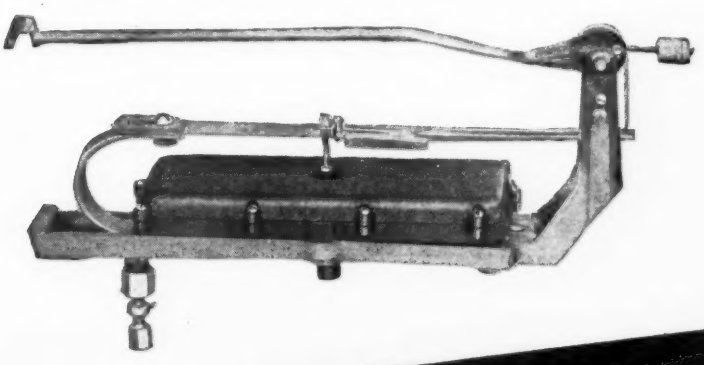


Series B
size
7" x 5"

HAYS offers a complete line of pointer-type draft gages designed to fit every need and every budget.

No longer is it necessary to buy a large gage when a small one is available that will serve quite as well or better. No longer need you try to make one size gage handle all drafts.

All these gages have the famous Hays slack diaphragm unit for ranges of draft or pressure from 0 to 120 inches of water. For ranges above 100 inches, Bourdon Tubes are used. For full description of these better gages, in all sizes and ranges, send for Bulletin 45-667.



The HAYS CORPORATION
SINCE 1901
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

Weigh

the advantages of

PEROLIN FUEL OIL TREATMENT

against those of any ordinary "sludge remover"

Why be satisfied with an ordinary "sludge remover" when you can obtain PEROLIN—a *complete* Fuel Oil Treatment—that really "conditions" the oil and increases efficiency, besides protecting your equipment?

PEROLIN FUEL OIL TREATMENT

Cuts Fuel Oil Costs . . .
by utilizing otherwise lost BTU's, thus more than repaying its cost

Reduces Carbon Formation . . .
by imparting a uniform viscosity to the oil, thus permitting a more accurate adjustment of the burner

Conserves Labor . . .
by avoiding frequent cleaning of the equipment

Eliminates Water in the Oil . . .
by emulsifying it with the oil

Protects the Tank Against Corrosion . . .
by neutralizing the free acid contained in heavy fuel oils and by dispersing water

Improves Combustion . . .
by helping to provide a smoother flame

Safe to Handle · **Non-Explosive** (Flashpoint 180° F.)

Send for these booklets:
"Trouble-Free Oil Burner Operation," describing what PEROLIN FUEL OIL TREATMENT will do for you.

"PEROLIN PRODUCTS for Better Maintenance," describing many other money- and labor-saving products for your plant.

PEROLIN COMPANY
Manufacturing Chemists since 1904

10 East 40th Street
New York 16

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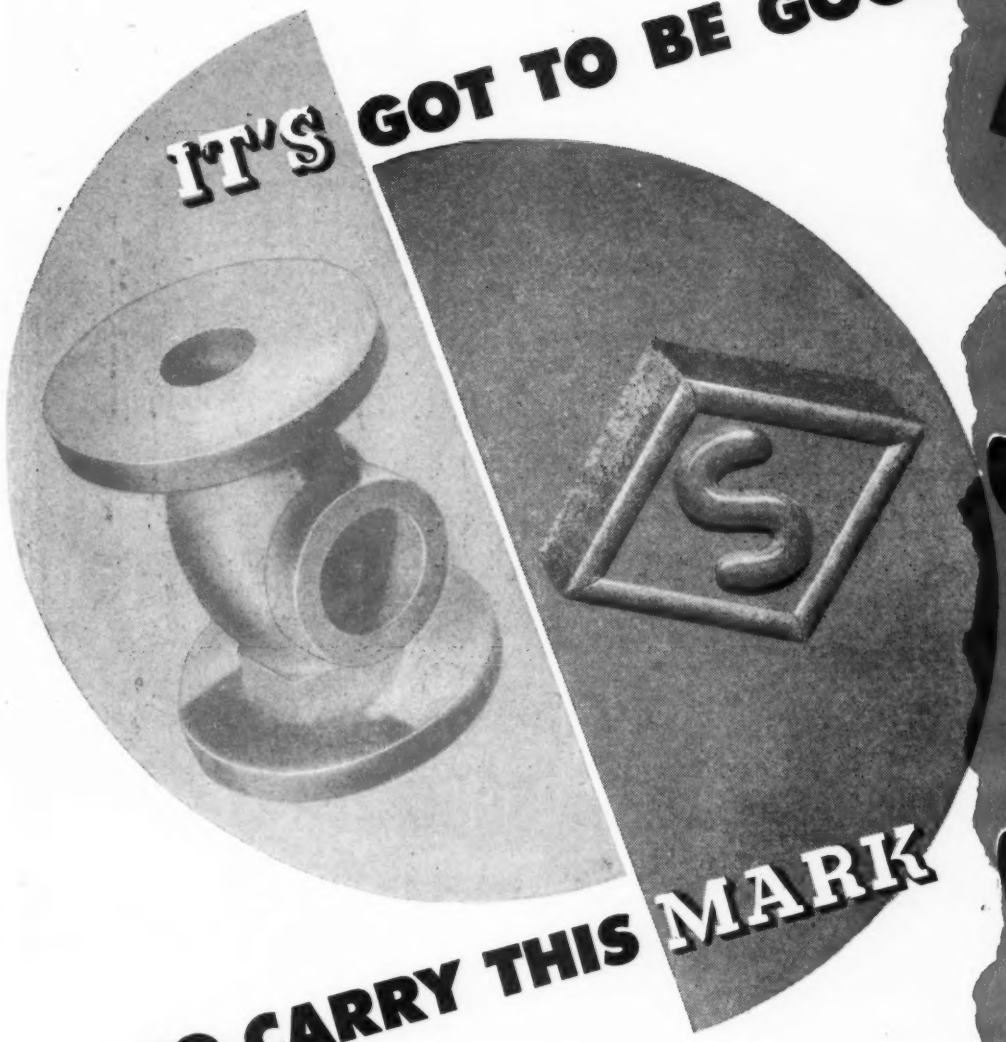
Chicago 9

REPRESENTATIVES IN ALL MAJOR CITIES

IT'S GOT TO BE GOOD TO CARRY THIS MARK



SIVYER STEEL CASTINGS

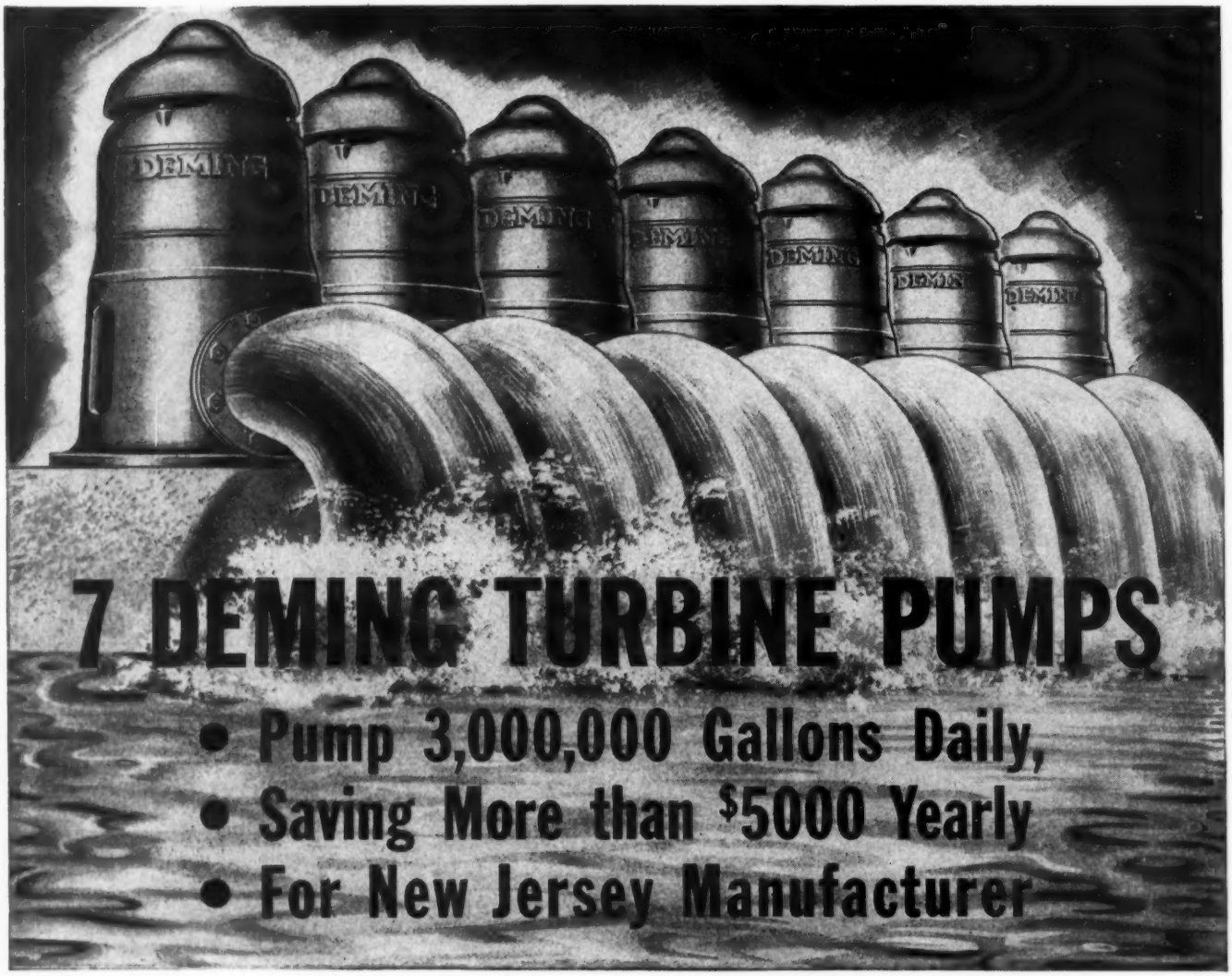
Sivyer steel castings have to earn the right to wear this mark ◈ —the Sivyer diamond. They have to prove they're the kind of castings that will deliver long service . . . trouble-free, money-saving service. For only after passing Sivyer's rigid examination and tests do they go to you.

In addition to perfect castings . . . castings of greater integrity of metal . . . Sivyer castings also are finished to a greater degree. In size, shape and contour, they are blueprint accurate. This means less processing . . . less handling on your part.

These two benefits are yours when you specify Sivyer Castings that get on the job *faster* and stay there *longer.*

SIVYER STEEL CASTING COMPANY

MILWAUKEE ◈ CHICAGO ◈



7 DEMING TURBINE PUMPS

• Pump 3,000,000 Gallons Daily,
• Saving More than $5000 Yearly
• For New Jersey Manufacturer

The first of seven Deming Deep Well Turbine Pumps was installed ten years ago for a manufacturer in New Jersey. That first pump was "on probation" as the manufacturer was frankly skeptical that a motor driven pump could reduce operating costs and, at the same time, increase the yield from each well in a comparison test with the steam driven air lift system employed for factory water supply.

RESULTS OF THE TEST

1. Efficiency factor:
Air lift system pumped 5.2 G.P.M. per H.P.
Deming Turbine pumped 20.8 G.P.M. per H.P.

2. Capacity factor:
Air lift system yielded 96½ G.P.M.
Deming Turbine yielded 208½ G.P.M.

3. Cost factor:
Savings of more than $5000 annually with Deming Turbine Pumps.

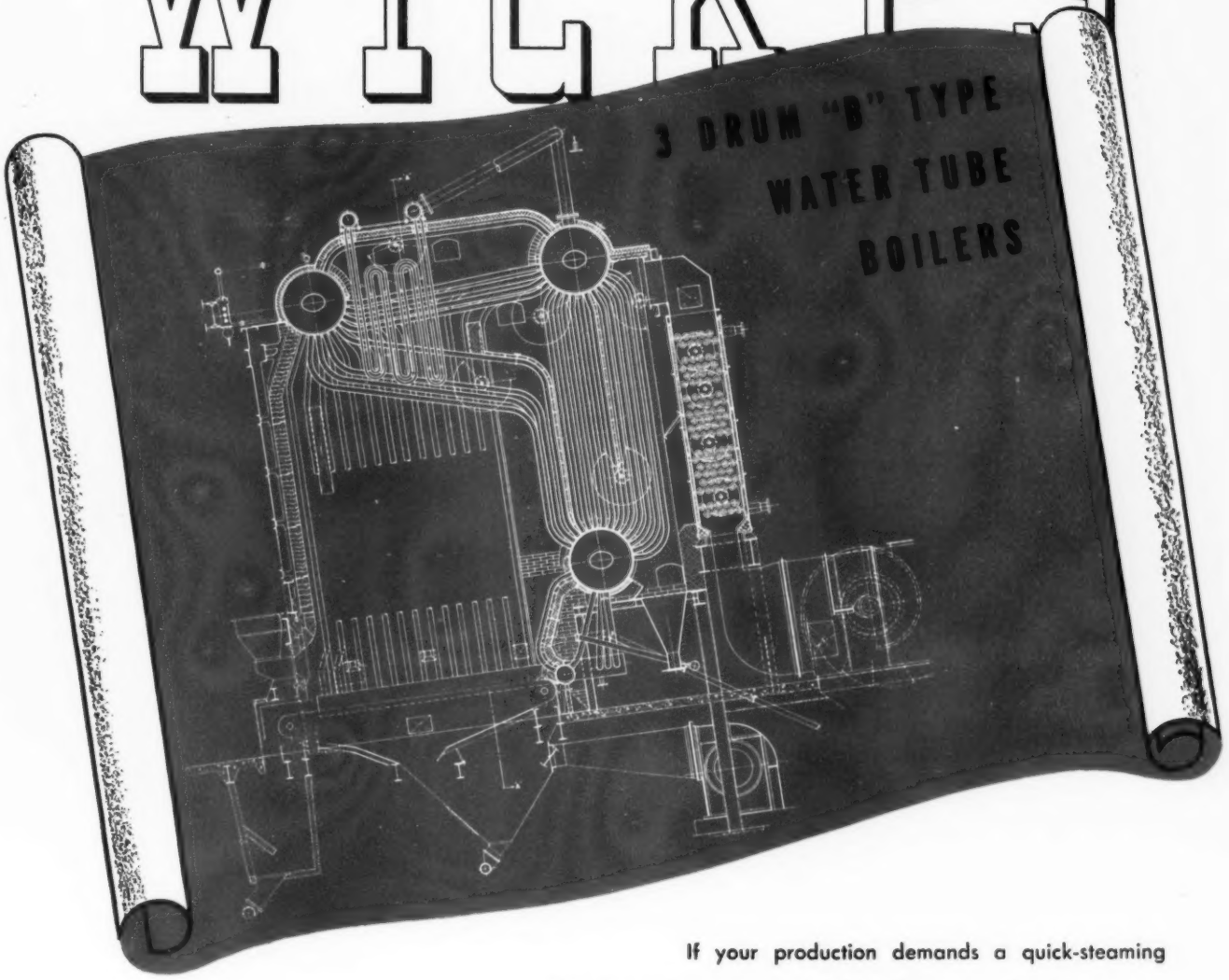
Seven Deming Deep Well Turbine Pumps were installed to replace the former steam driven air lift system. Those seven pumps increased the total yield from 2¼ million gallons daily to more than 3 million gallons daily AT LESS COST!

THE DEMING COMPANY • SALEM, OHIO

You can pump MORE for LESS

with **DEMING** *deep well turbine pumps*

WICKES



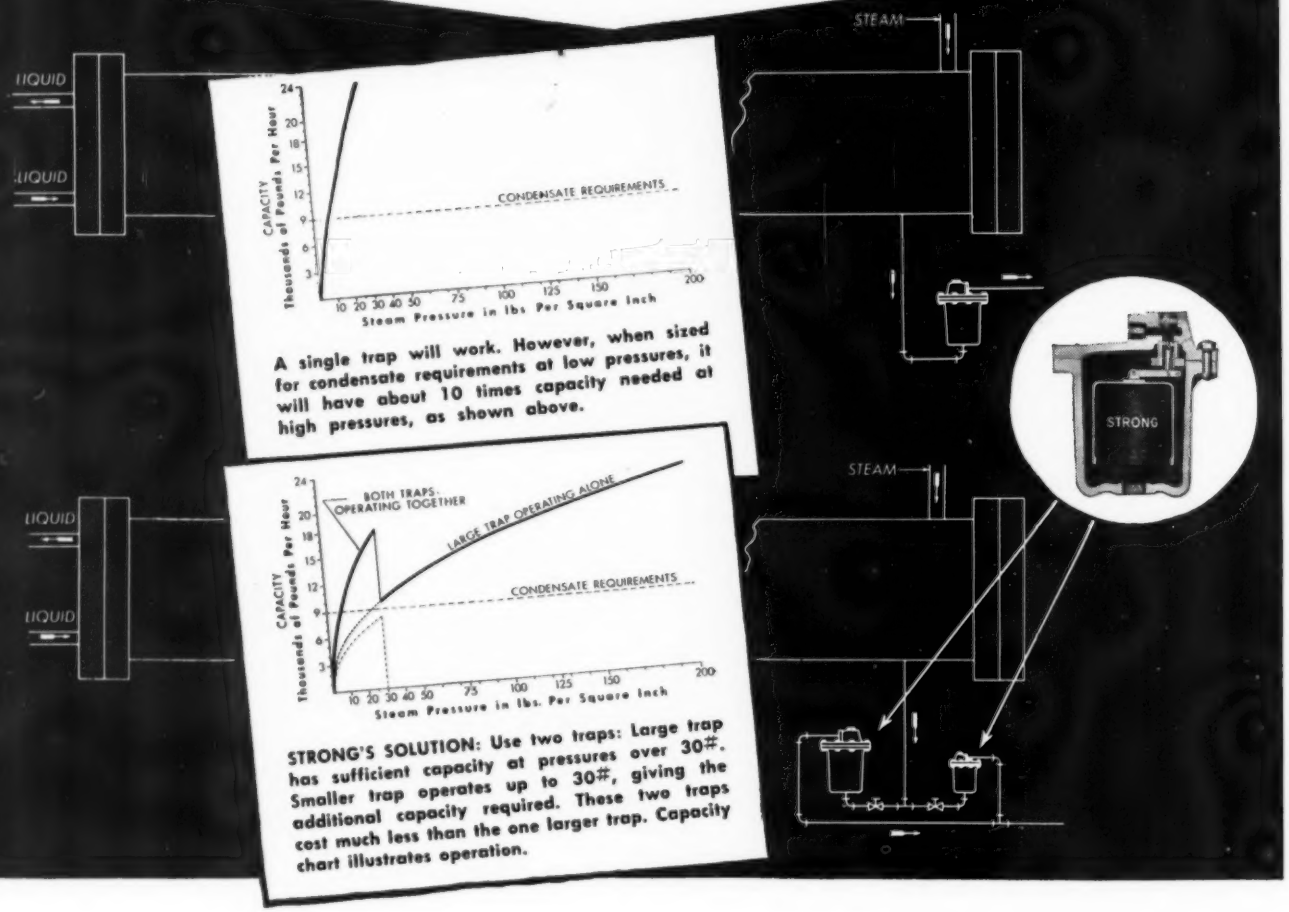
If your production demands a quick-steaming boiler that will operate with high efficiency at loads up to 250,000 lb. per hour, it will pay you to investigate Wickes 3-Drum Water Tube Boilers. Wickes Boilers have rapid and unrestricted water circulation; properly baffled passages for products of combustion; long drums with fusion welded seams; tubes bent to easy radius and arranged for more effective absorption of radiated furnace heat; and 100% adaptability to any type of firing equipment. Entire installation easily accessible for inspection and maintenance. Send us your power problems and our engineers will help you determine whether a Wickes 3-Drum or other type of Wickes boiler will effect greater power efficiency and economy in your plant.

THE WICKES BOILER CO.
SAGINAW, MICHIGAN, EST. 1854

SALES OFFICES: Detroit, Mich.; Chicago, Ill.; New York City; Milwaukee, Wisc.; Pittsburgh, Pa.; San Jose, Calif.; Tulsa, Okla.; Fort Worth, Texas; Portland, Ore.; Saginaw, Mich.; Boston, Mass.; Indianapolis, Ind.; Baltimore, Md.; San Francisco, Calif.; Mexico City, Mexico.

WHERE 2 TRAPS COST LESS THAN 1

PROBLEM: Extreme pressure variation.
EXAMPLE: Heat exchanger with pressures from 10# to 200#; condensate 9,000# per hour.



A single trap will work. However, when sized for condensate requirements at low pressures, it will have about 10 times capacity needed at high pressures, as shown above.

STRONG'S SOLUTION: Use two traps: Large trap has sufficient capacity at pressures over 30#. Smaller trap operates up to 30#, giving the additional capacity required. These two traps cost much less than the one larger trap. Capacity chart illustrates operation.

"KNOW-HOW" TO DO MEANS *"KNOW-HOW"* TO SAVE!

There are always different ways to apply steam traps to a given problem.

Some are better than others, and reduce steam costs or increase production or insure product quality. Here efficiency means economy.

Occasionally, less expensive hookups can give the same results as costly equipment. Here ingenuity, thorough knowledge and a complete line of steam specialties give a practical answer at desirable savings.

In either case, the "know-how" of Strong engineers is at your service. Their recommendations are backed both by long experience and the complete Strong line, including open and inverted bucket, closed float, float-and-thermostatic (blast) traps, etc.—forged, fabricated (welded) cast and semi-steel construction. Send your problems to Strong, Carlisle & Hammond Company, Cleveland 13, Ohio. No obligation, of course.

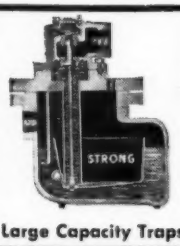
STRONG, CARLISLE & HAMMOND COMPANY
Cleveland 13, Ohio

REG. TRADE MARK

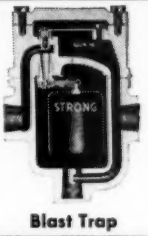
OTHER ANUM-METL Reg Trade Mark

STRONG

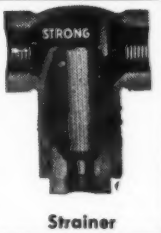
STEAM SPECIALTIES



Large Capacity Traps



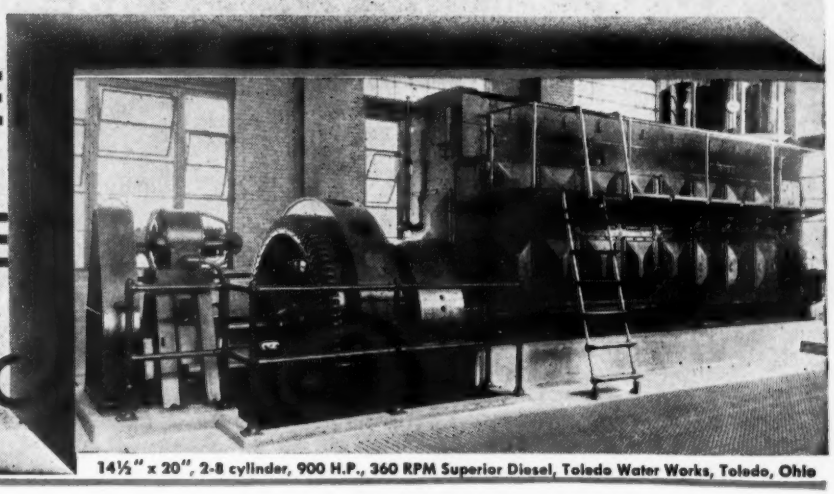
Blast Trap



Strainer

DEPENDABLE POWER • DEPE
COST • LOW MAINTENANCE COST •
DABLE POWE ENDABLE
LOW MA ST • LOW M
POWER • NDABLE POWER
MAINTENANCE COST • LOW MAIN
DEPENDABLE POWER • DEPE
COST • LOW MAINTENANCE COST •
DABLE POWER • DEPENDABLE
LOW MAINTE
POWER • DE
MAINTENANC

Superior DIESEL



14½" x 20", 2-8 cylinder, 900 H.P., 360 RPM Superior Diesel, Toledo Water Works, Toledo, Ohio

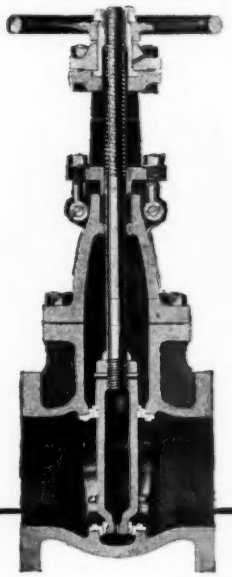
SUPERIOR DIESELS • MARINE • STATIONARY • LOCOMOTIVE

Superior ENGINES
Division of THE NATIONAL SUPPLY CO.
Plant and General Sales Office: Springfield, Ohio

"Trifles make perfection but perfection is no trifle"

One of a series of advertisements explaining how Kennedy gives careful attention to the details of valve design, construction and workmanship that provide maximum effectiveness, convenience, and length of service.

Only the KENNEDY WEDGE GATE VALVE has all these features



Some of these details provide extra strength, others provide extra tightness, resistance to wear, ease of operation or convenience of repacking or dismantling and reassembly.

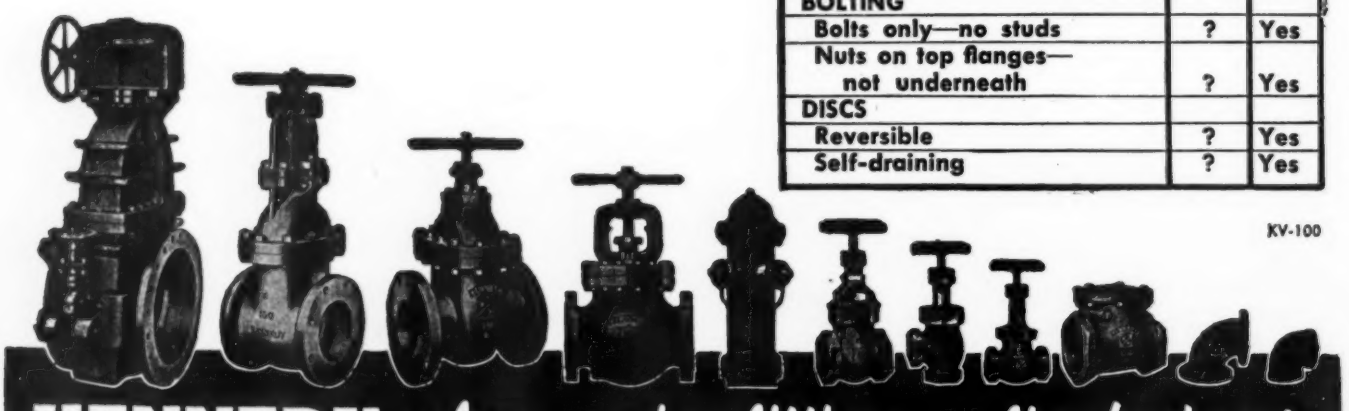
Some of the details are vital to satisfactory service, and others are of lesser importance . . . but they show the careful attention to every element of valve design and construction that gives you extra value at no extra cost when you buy KENNEDY Valves.

The KENNEDY Catalog describes all the special features of these extra value valves and lists the entire line of KENNEDY Iron Body and Bronze Valves for all standard pressures and services. Write for your copy today to help make a selection for trial.

THE KENNEDY VALVE MFG. CO.
ELMIRA • NEW YORK

	Your Present Wedge Gate Valves	KENNEDY Std. Iron Body
BODY		
True oval body	?	Yes
Lugs on screwed ends	?	Yes
Reinforcing web an flanged ends	?	Yes
YOKE		
One-piece yoke	?	Yes
Ledges for gland	?	Yes
Separate Yoke Cap with 4 bolts	?	Yes
Lubricating hole for thrust collar	?	Yes
STUFFING BOX		
Bronze bushing in gland	?	Yes
Slotted gland on O S & Y	?	Yes
Swing bolts on O S & Y	?	Yes
Washer nuts on bolts	?	Yes
Bronze bushing at stuffing box	?	Yes
Rust-proofed bolts and nuts	?	Yes
BOLTING		
Bolts only—no studs	?	Yes
Nuts on top flanges—not underneath	?	Yes
DISCS		
Reversible	?	Yes
Self-draining	?	Yes

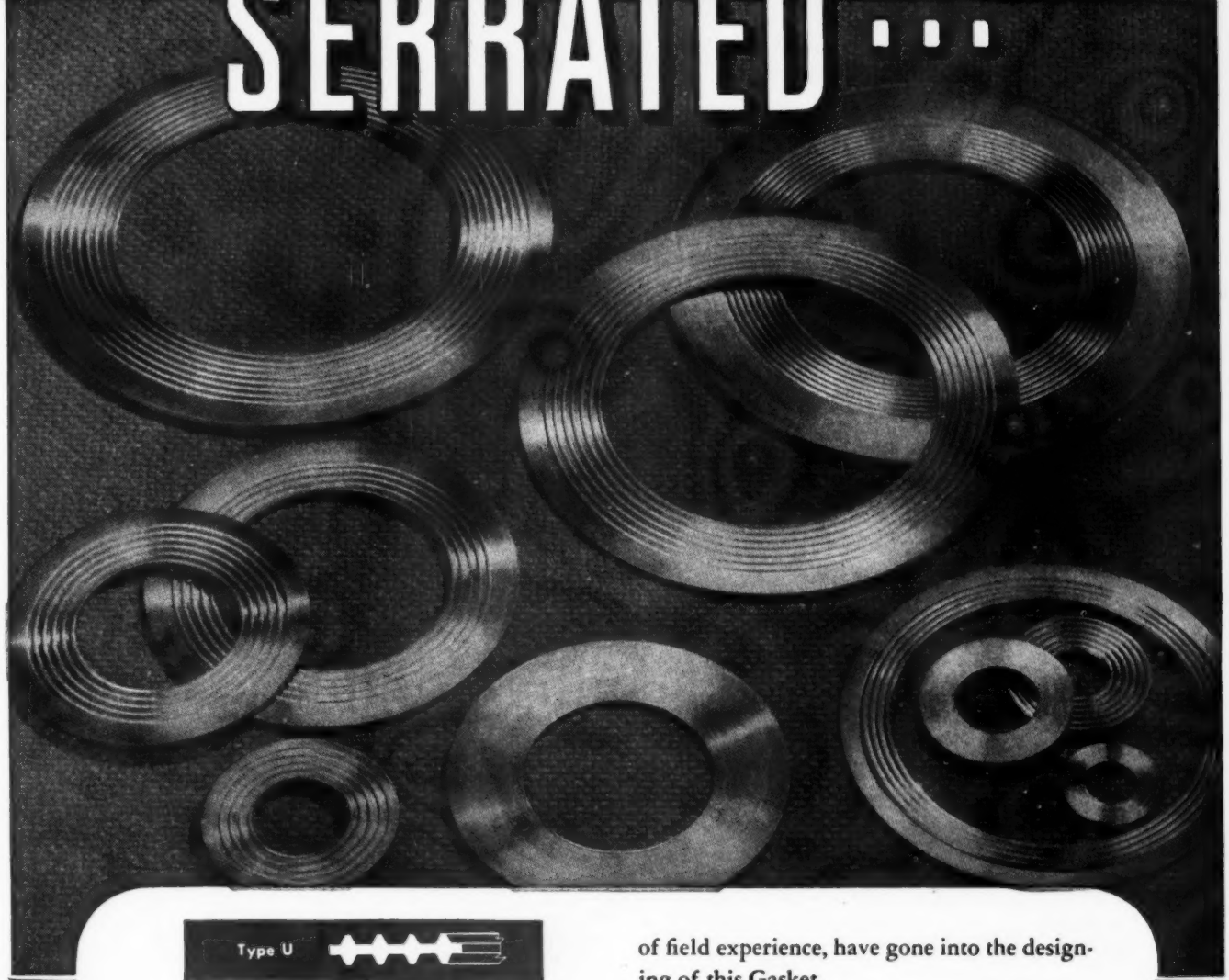
KV-100



KENNEDY *valves . . . pipe fittings . . . fire hydrants*

MODERN DEVELOPMENTS OF GASKET RESEARCH

SERRATED . . .



Type U

For high pressure steam, process equipment and piping, Goetze Serrated and Profile Gaskets are growing in popularity for services requiring an all-metal gasket having high unit gasket stress at moderate bolt loads.

It is supplied in a wide range of metals and with serrations of a pitch designed to meet the individual needs of specific equipment and operating conditions.

Many hours of laboratory experiment, mechanical and metallurgical research, and years of field experience, have gone into the designing of this Gasket.

Ask to have your name added to the list of engineers receiving "The Gasket"—a series of technical bulletins containing original gasket data emanating from the Goetze Research Laboratory. Write on your company letterhead giving your position.

GOETZE GASKET & PACKING CO., INC.
10 ALLEN AVENUE, NEW BRUNSWICK, N. J.

Boston *New York* *Philadelphia* *Pittsburgh*
Cincinnati *Cleveland* *Detroit* *Chicago*
Houston *San Francisco* *Los Angeles* *Montreal*

Goetze for GASKETS

"America's Oldest and Largest Industrial Gasket Manufacturer"

Union Finished Steel Roller Chain is manufactured in all standard sizes from ⅜" to 2½" pitch, in single and multiple strands.

When You Have a Choice, Choose Chain

☆ Making a selection from the fabrics which the tailor has on hand is a matter of personal taste. When you have a power transmission problem, look at the facts before you decide.

A roller chain drive may be compared in mechanical principle to a flexible rack and pinion, with the additional advantage of a rolling engagement between chain and sprockets. Roller Chain drives are free from slippage and are not limited to fixed centers. They possess flexibility to absorb shock and impact loads. Compact Chain drives are adaptable to high speed ratios.

When you have a choice between chains, choose Union Chain, built by chain specialists in a plant exclusively devoted to the manufacture of dependable Chain. Write for the Union story.

The Union Chain and Manufacturing Company, Sandusky, Ohio. U. S. A.

Union Chains for Every Application

Drive and Conveying Chains and Sprockets

- Bridge Chain
- Combination Malleable Iron and Steel Chain
- HB (hardened bearing) type chain
- BP (bar and pin) type chain

★

Finished Steel Roller Chains and Sprockets

- All manufacturer's standard, size ⅜ in. to 2½ in. pitch
- Single and Multiple Strands
- Extended Pitch Series in sizes 1¼ in. to 4 in. pitch

★

Silent Chain and Sprockets

- All sizes ⅜ in. to 1½ in. pitch

★

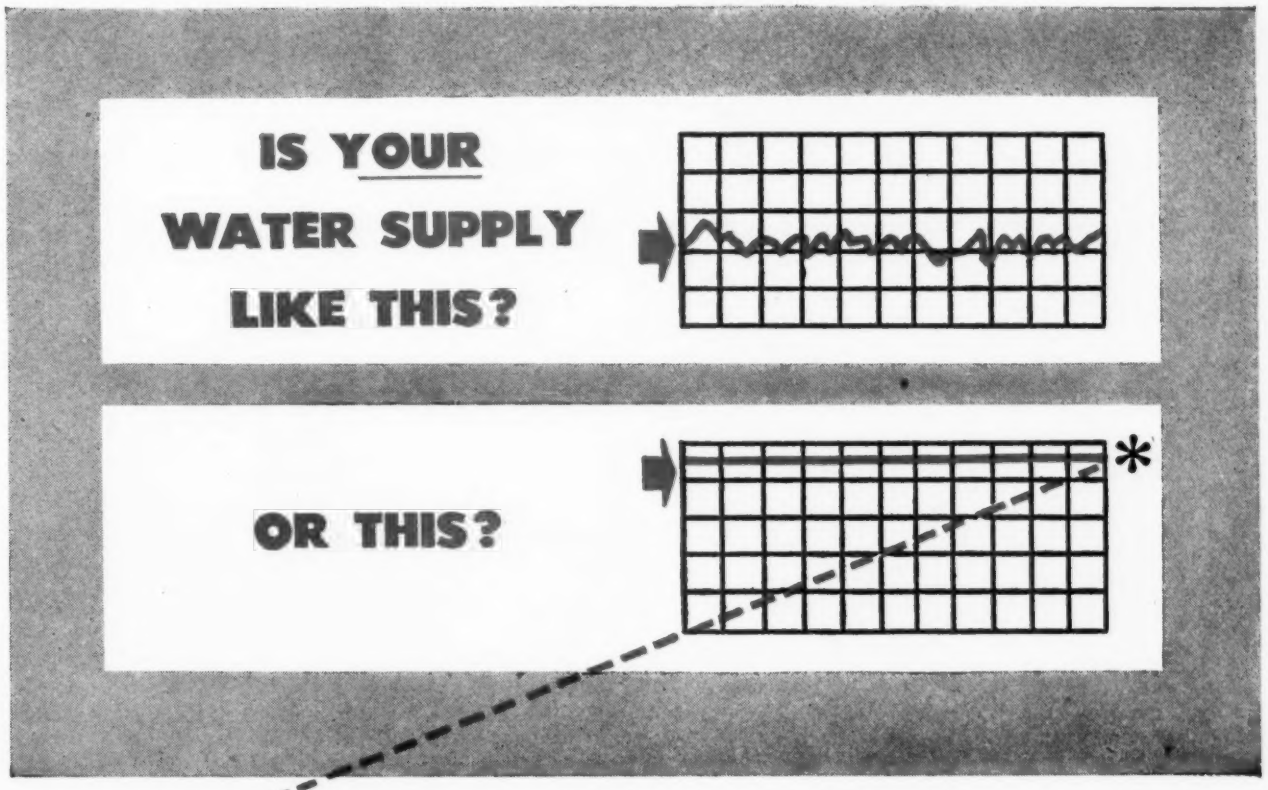
Flexible Couplings

- Roller chain type
- Silent chain type

Catalog A-2 covers Drive and Conveying Chain. B-2 covers Finished Steel Roller Chain. FC-1 covers Flexible Couplings. Ask for your copies.

ARMY ★ NAVY

UNION CHAINS



*AMBERLITE SOFTENED WATER

Remains constant in quality regardless of supply fluctuations

You can soften huge quantities of water—for boiler and evaporator feed or cooling purposes—and do it rapidly, easily and economically, when you use AMBERLITE Ion Exchange Resins.

Regardless of seasonal variations in raw water source, you can completely remove scale-forming impurities, effectively reduce alkalinity, and cut your blow-down losses.

Water-softening equipment using the AMBERLITES requires little space—minimum maintenance. It is simple and flexible in operation—gives maximum capacity at high flow rates.

For complete information regarding the use of AMBERLITE Ion Exchange Resins in your plant or equipment, consult our technical staff.

AMBERLITE *is a trade-mark, Reg. U. S. Pat. Off.*

THE RESINOUS PRODUCTS & CHEMICAL COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Remember this

ONE *fact!*

BIRD-ARCHER

Offers 60 years Experience and Research
in the field of

INDUSTRIAL WATER CONDITIONING

FOR STEAM OR PROCESS REQUIREMENTS

Consultation without Obligation

THE BIRD-ARCHER CO.

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SURVEYS • PLANT STUDIES
PLANT DESIGN • TREATMENTS

SUPERVISORY SERVICE •
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Write for this Boiler Book ..... It describes
and illustrates with actual installations .....
Union's Basic Boiler Designs ..... It offers
the complete Union Boiler Line in 20 easily
read pages .....

UNION IRON WORKS • ERIE, PA.•

Material sold by Mound City Erection Co., St. Louis, Mo., approved K & M distributors in this area.

ASBESTOS IN ACTION

BUILT TO LAST

Here is a roofing and siding that defies time and wear

K&M "Century" ASBESTOS CORRUGATED

This interesting St. Louis plant follows a modern trend in industrial building construction. The exterior of the building, involving a total area of 200,000 square feet, is completely clad with one of the toughest and most durable of all sheathing materials . . . K&M "Century" Asbestos Corrugated roofing and siding.

Whether your building plans call for new construction, remodeling or repairs, it will pay you to investigate the many distinctive features of K&M "Century" Asbestos Corrugated and Flat Lumber.

TOUGH . . . made of asbestos and portland cement combined under tremendous hydraulic pressure.

ADAPTABLE . . . for all types of industrial buildings—new construction, remodeling, repairs.

ATTRACTIVE . . . has neutral gray color, practical finish, never needs protective paint.

LONG LASTING . . . will not rust, corrode, rot . . . proof against weather, rodents, termites.

FIRE RESISTANT . . . thus earning low insurance rates.

TIME SAVING . . . comes in 19 different lengths and one standard width . . . easy to handle . . . goes up fast.

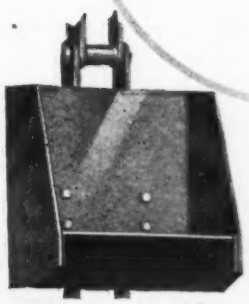
Build to last, and save time and money the "Century" way. Bring your problems to your authorized K&M Distributor. He is well equipped to meet your material and installation requirements for "Century" Asbestos Corrugated and Flat Lumber.

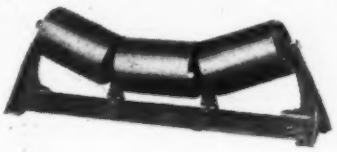
Nature made Asbestos . . . Keasbey & Mattison has been making it serve mankind since 1873.

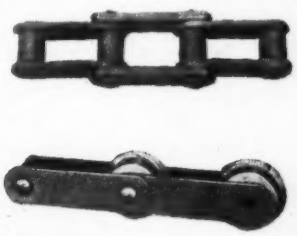
KEASBEY & MATTISON

COMPANY • AMBLER • PENNSYLVANIA

HIGH DEPENDABILITY
LOW OPERATING COST
with genuine Jeffrey
REPLACEMENT PARTS







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CONVEYORS
CRUSHERS
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ESTABLISHED 1877

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Boston 16 Cincinnati 2 Detroit 32 Philadelphia 3 Salt Lake City 9
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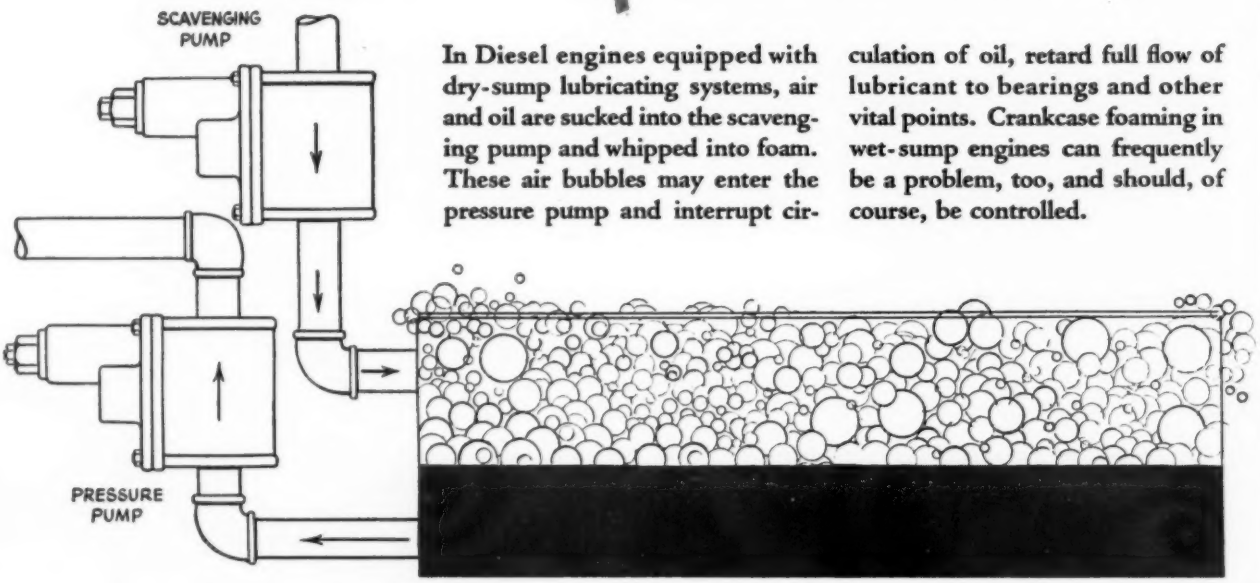
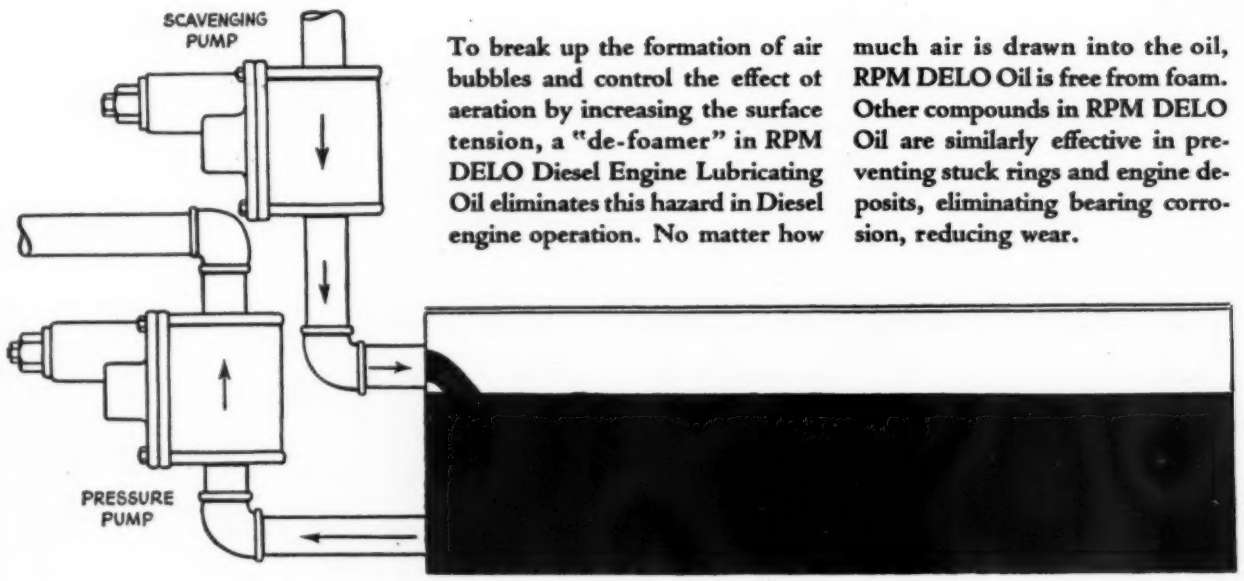
Diesel Engine DANGER points

AIR BUBBLES ENDANGER OIL CIRCULATION



In Diesel engines equipped with dry-sump lubricating systems, air and oil are sucked into the scavenging pump and whipped into foam. These air bubbles may enter the pressure pump and interrupt circulation of oil, retard full flow of lubricant to bearings and other vital points. Crankcase foaming in wet-sump engines can frequently be a problem, too, and should, of course, be controlled.

RPM DELO OIL PREVENTS CRANKCASE FOAMING



To break up the formation of air bubbles and control the effect ot aeration by increasing the surface tension, a "de-foamer" in RPM DELO Diesel Engine Lubricating Oil eliminates this hazard in Diesel engine operation. No matter how much air is drawn into the oil, RPM DELO Oil is free from foam. Other compounds in RPM DELO Oil are similarly effective in preventing stuck rings and engine deposits, eliminating bearing corrosion, reducing wear.

To match the fine performance of RPM DELO OIL, use these equally efficient companion products from the same famous "RPM" line—RPM HEAVY DUTY MOTOR OIL—RPM COMPOUNDED MOTOR OIL—RPM GEAR OILS AND LUBRICANTS—RPM GREASES. For additional information or name of your distributor, write any of the companies below:

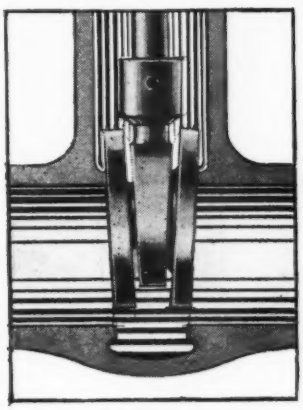
STANDARD OF CALIFORNIA · 225 Bush St., San Francisco 20, California
THE CALIFORNIA COMPANY · 17th and Stout Streets, Denver 1, Colorado
STANDARD OIL COMPANY OF TEXAS · El Paso, Texas
THE CALIFORNIA OIL COMPANY · 30 Rockefeller Plaza, New York 20

RPM DELO
DIESEL ENGINE LUBRICATING OIL

ALOYCO No. 111 GATE
Leader of Corrosion-Resistant Valves

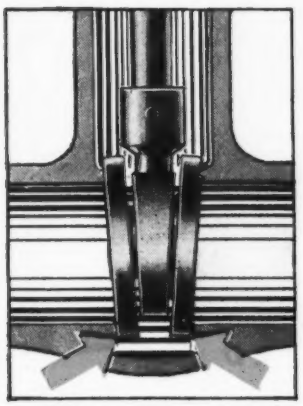
This GATE VALVE MAKES ASSURANCE DOUBLY SURE

This valve has what it takes to handle tough corrosive solutions. Double rotating wedges provide drop-tight closure and long life under severe operating conditions. Has precision construction, superfine machine finished seating surfaces and unique design. Available in Aloyco 20, 18-8S, 18-8 SMo, the higher Chrome-Nickel series, Worthite, Hastelloy, Monel and pure Nickel. If you handle corrosive fluids or vapors, investigate this valve. Write for circular.



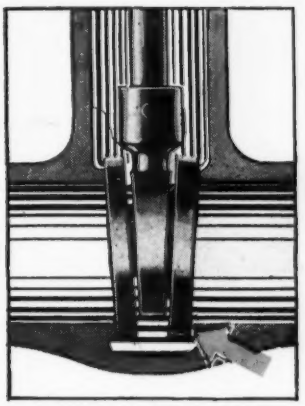
FLOATING DISCS, FREE TO ROTATE WEAR EVENLY

Being free to rotate, the twin discs cut sludges, slurries and viscous solutions. Not held to one point, they wear evenly.



WEDGE—RING FORCES DISCS AGAINST SEATS SEALING THE PORTS

Simple ball and socket construction permits wedge to "take-up" any unevenness and provides better metal-to-metal contact.



DOUBLE VALVE EFFECT! IF ONE DISC LEAKS — OTHER CAN STILL *SEAL*

Should pipe misalignment, shock or scale prevent one disc from seating, the other can still be "drop-tight." Like two valves on one line!

REPAIR WITHOUT SPECIAL TOOLS OR JIGS

Husky ring is both threaded and pinned to stem, minimizing chances of loosening.

Weld metal may be deposited here to restore original contact dimensions when re-seating is required.

Ball and socket provide gripping surface for re-seating in lathe.

ALOYCO

STAINLESS STEEL VALVES AND FITTINGS

GATE, GLOBE, Y, CHECK, TANK, SAMPLING AND V-PORT VALVES
SCREWED, FLANGED AND WELDED FITTINGS

ALLOY STEEL PRODUCTS COMPANY, INC.

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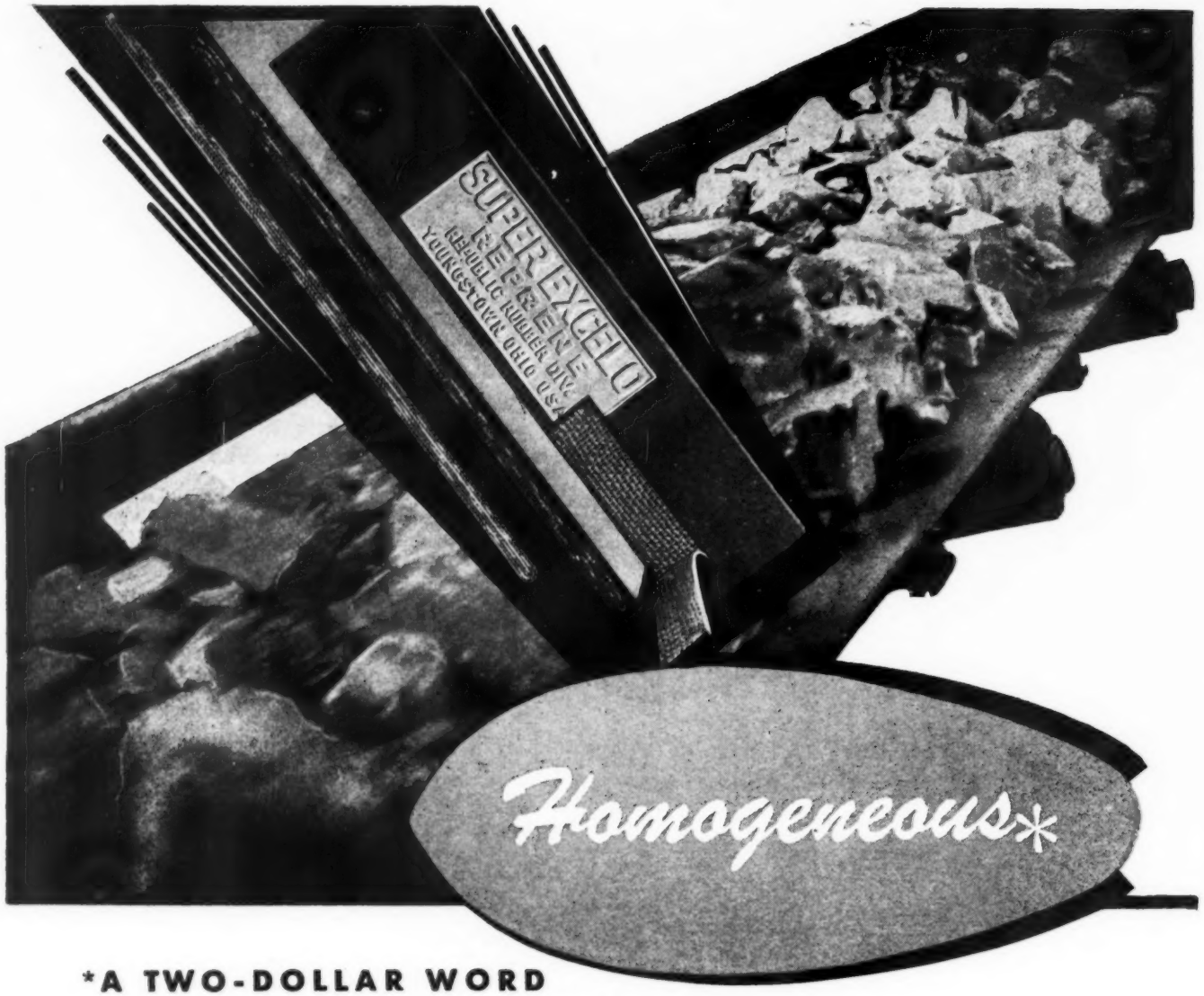

A TWO-DOLLAR WORD THAT'S WORTH A LOT MORE TO USERS OF *Republic Conveyor Belting

To take buffeting impact, constant flexing, other service stresses without breaking down, a conveyor belt carcass has to be a uniform, virtually inseparable combination of reinforcing materials and rubber compounds. Republic belt-building experts use the word homogeneous to describe the structure of such carcasses—and to their skilled hands and eyes goes the credit for making sure this is accomplished in each Republic Conveyor Belt. This is one of the reasons Republic Conveyor Belts have set records for longer, more troublefree service in hundreds of industries from coast to coast. Consult your nearby Republic Distributor.

WE ARE PARTICIPANTS IN THE OWNERSHIP AND OPERATION OF NATIONAL SYNTHETIC RUBBER CORPORATION

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DOWELL

Full blast!

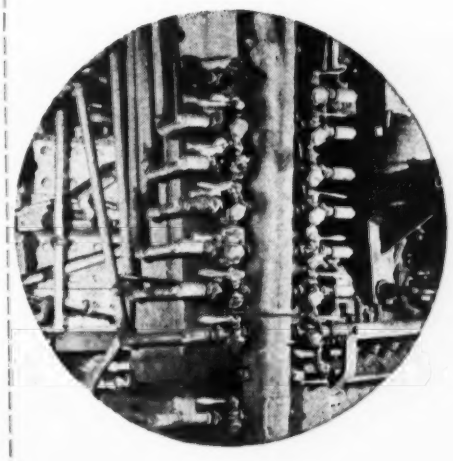
while chemicals clean

the cooling system

Steel plant operators are finding that the Dowell method of *chemically dissolving* accumulated scale is the modern, rapid way to clean hearth plate cooling coils without shutting down production.

Dowell chemically cleans cooling stack plates, bosh plates, gas scrubbers, boilers, dust precipitators, condensers, filter beds and water lines above or below ground . . . also steam generating equipment, furnace equipment, mills, cooling machinery, locomotive equipment, by-product coke plants and heating systems.

Dowell specialists offer a complete cleaning service to steel mills and industries of every sort. They chemically analyze samples of deposits taken from *your* equipment, prepare the proper solvents and bring with them all treating equipment needed. Call the nearest Dowell office for a free estimate. Ask for "More Power to America's Industry"—new color booklet describing Dowell Chemical Cleaning Service.



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Subsidiary of The Dow Chemical Company

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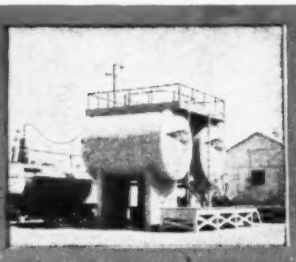
SPECIALISTS IN CHEMICAL CLEANING SERVICE

Dowell's experienced industrial engineers are backed by the complete research and technical facilities of The Dow Chemical Company.

Dowell's equipment is modern and complete—scientifically designed. Treating stations and chemical warehouses conveniently located.



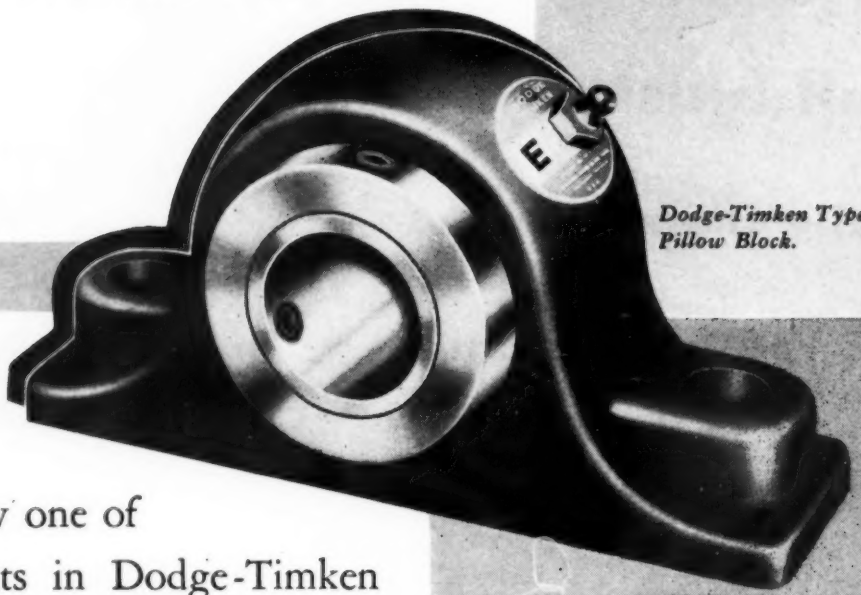
Dowell cleaning solvents are "tailor-made" to fit each job. All ingredients are of the highest quality, chosen for best results in your plant.

DOWELL

FOR INDUSTRIAL CHEMICAL SERVICE

Dodge + Timken

THE COMBINATION FOR POWER ECONOMY



Dodge-Timken Type "E" Pillow Block.

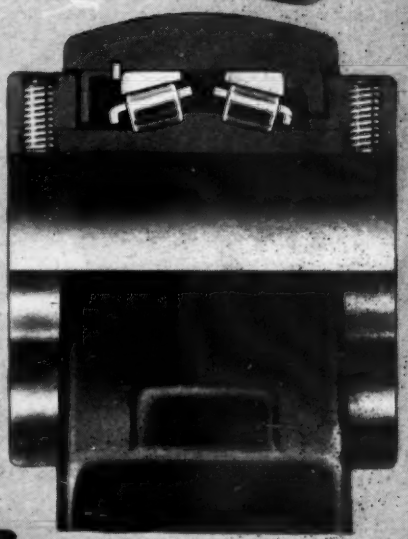
The photographs show one of the latest developments in Dodge-Timken Pillow Blocks. This is the type "E", designed to provide Dodge-Timken efficiency at the lowest possible cost.

Are you paying for power you are not using? Now is the time to find out. Check up on your transmission equipment and replace the power wasters with modern Timken Bearing Equipped power savers. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

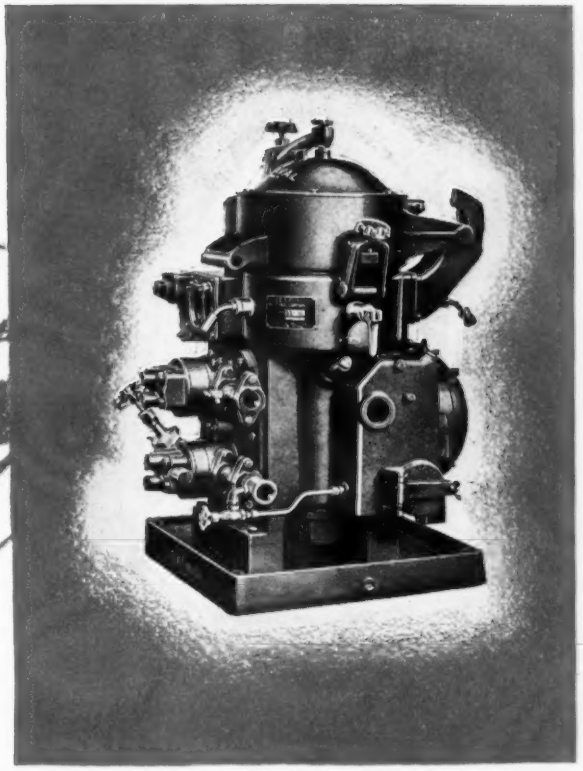
TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



Cross sectional view of Dodge-Timken Type "E" Pillow Block.

GIVE YOUR TURBINE . . .



PROTECT your turbine from ***both*** of the chief causes of lubrication failure—dirt and water. To rid the lubricating oil of dirt only is to give the turbine just ***half*** of the protection it requires.

A De Laval Oil Purifier provides a simple, effective means of insuring against the troubles caused by water and dirt. Its purifying action is instantaneous and wholly mechanical. Foreign material is thrown out by centrifugal force, and this centrifugal force removes from the oil and continuously discharges condensate or other water.

If a turbine protected by a De Laval Oil Purifier should develop a water leak, the excess of water would likewise be removed before damage could be done. There would be no sudden formation of "liver" in the lubrication system.

De Laval Oil Purifiers have another inherent advantage—they discharge the purified oil with oil-soluble additives intact.

- Write for Bulletin 400 for details.

DE LAVAL

THE DE LAVAL SEPARATOR COMPANY
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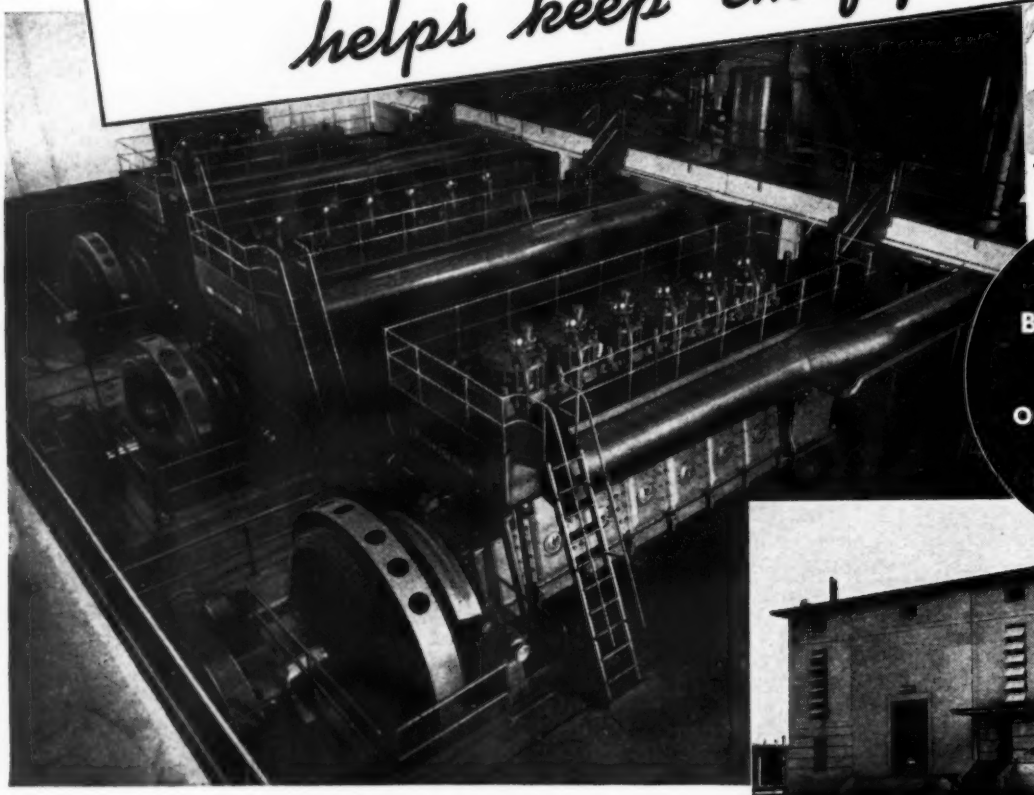
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

LUBRICATING OIL PURIFIERS

NORDBERG DIESELS

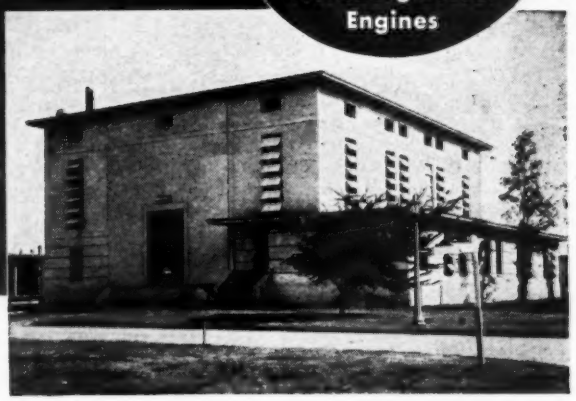
on the ground *helps keep 'em flying*



U. S. Army Air Base Borinquen Field Puerto Rico

•

One 2000 H. P. and two 2400 H. P. Nordberg Diesel Engines

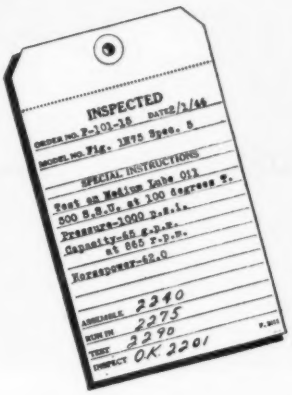


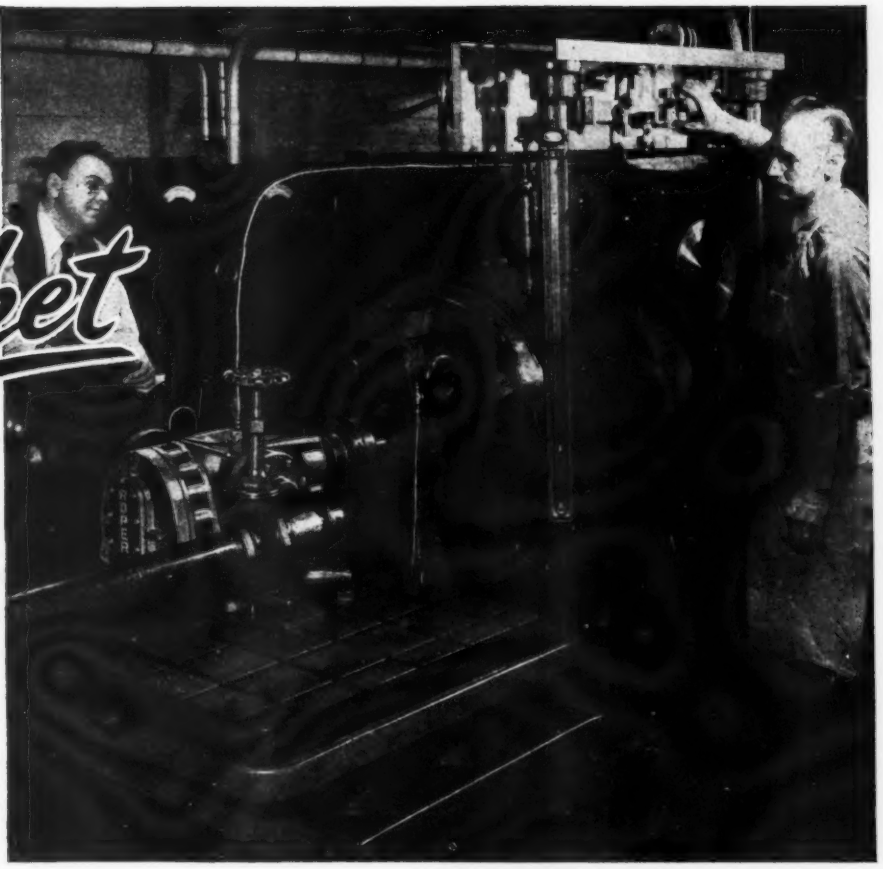
● It would be difficult to find a power generating station where dependability is of greater importance than it is in this plant which supplies electric service for America's great air base on Puerto Rico. In this as in many plants powered by Nordberg Diesels, every expectation for reliable performance has been met. Year in and year out faithful service given by hundreds of Nordberg Diesels have won for them a foremost place amongst operators who appreciate dependable Diesel power. If you are interested in a better and more economical source of power supply, investigate the merits of Nordberg Diesel power.

NORDBERG MFG. COMPANY • MILWAUKEE 7, WIS.

NORDBERG
DIESEL ENGINES

Your test-ticket

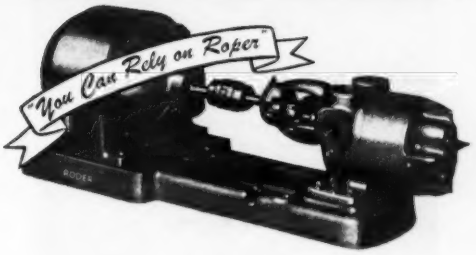




PUMP PROVING GROUND WORKS FOR YOU AT ROPER

Here on a dynamometer test block, a Roper 75 g.p.m. pump is put through its paces. With modern test facilities its performance is accurately measured, and results are predetermined. It is a painstaking procedure that is followed out at Roper to prove each pump.

Yes, prior to shipment, each Roper is given a rigid, individual horsepower and capacity test. And the test standards set up to meet requirements are recorded on the "test-ticket" which you receive with each pump. It's your insurance against faulty performance and costly time losses. For standard as well as for special engineered units, the proving ground works for you at Roper.



Proved Roper Features that Insure Dependable Service

Continuous bearing lubrication .. Axial hydraulic balance . . . Floating equal size external gears . . . Oversize bearings, gears supported at both ends . . . Efficient operation in either direction . . . Can be serviced without disturbing pipe connections, power unit or pump mounting . . . Packed box or mechanical seal units to suit requirements.

SEND FOR CATALOG TODAY

Illustrating and describing pumps built to handle pressures up to 1000 lbs. p.s.i., capacities ¾ to 300 g.p.m. at speeds up to 1800 r.p.m. Lists service and engineering offices in principal cities.

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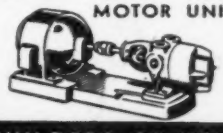
ROPER
Rotary Pumps

PUMPS ESPECIALLY ENGINEERED TO FIT YOUR REQUIREMENTS

MOTOR UNITS



FOOT MOUNTED

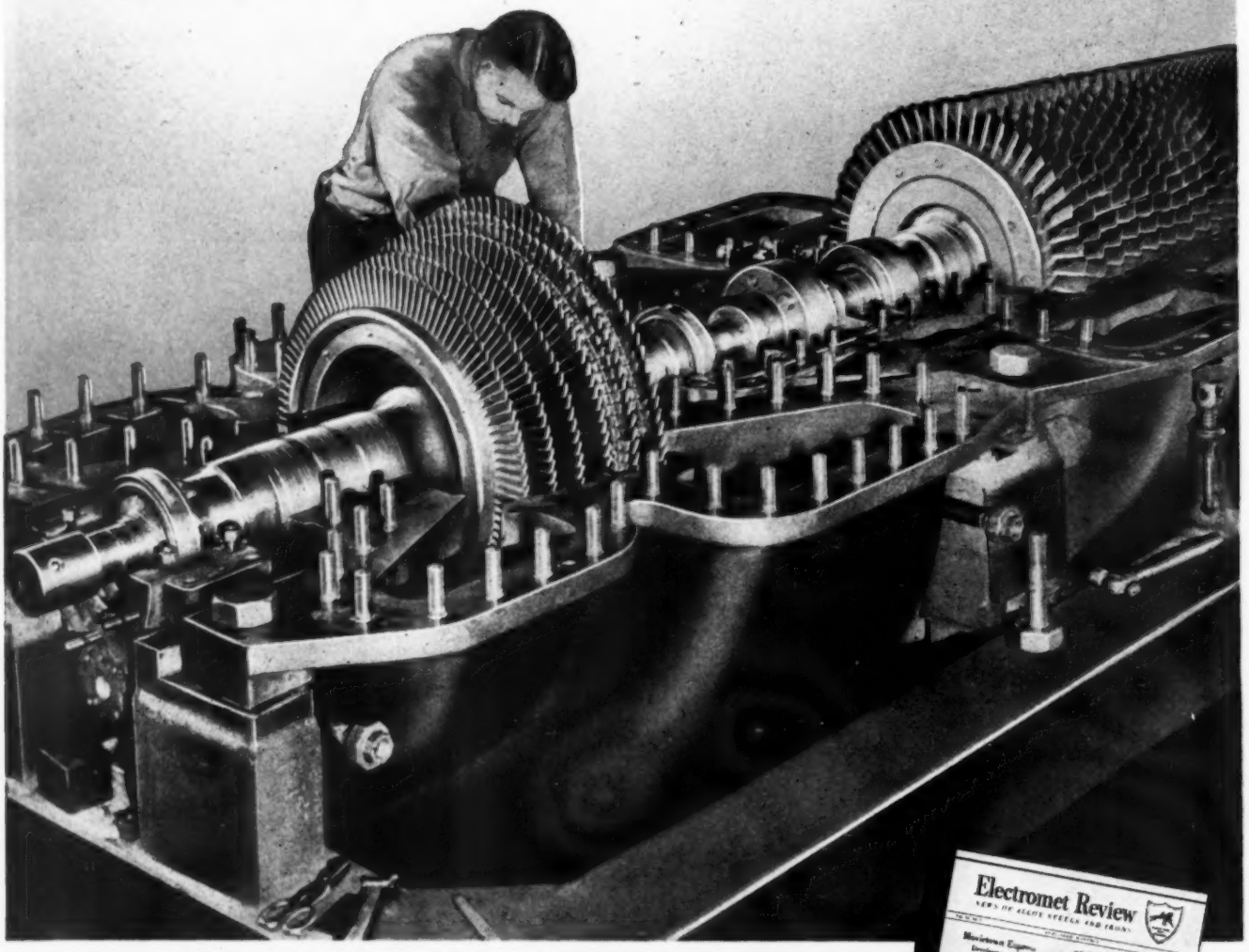
FLANGE MOUNTED

BUILDERS OF PUMPS FOR MANUFACTURING, MARINE, PETROLEUM, AND PROCESS INDUSTRIES

STAINLESS STEEL "*fire-eater*."

Engineers have long dreamed of building gas turbines, but, only recently have they had heat-resisting stainless steels that could stand up under the terrific heat and corrosive action of the flaming gases. The successful operation of stainless steel gas turbines, like the one pictured below, shows that these machines are now a practical power source for many industries.

While stainless steel is essential in gas turbines, there are many less severe applications in industry where this tough, heat-enduring metal also means longer life, fewer shut-downs, and more economical operation.



Other uses of stainless steel are described in ELECTROMET REVIEW, published by ELECTRO METALLURGICAL COMPANY, a Unit of UNION CARBIDE AND CARBON CORPORATION. ELECTROMET does not make steel, but produces the ferro-alloys used in its manufacture. If you need this complimentary publication, write to ELECTRO METALLURGICAL COMPANY, 30 East 42nd Street, New York 17, N. Y.

8 IMPORTANT REASONS—

Why It Will Pay You to Specify

RELIANCE Series "C" MOTORS

1. **Protecting enclosures** keep out dirt, chips, oil, excess moisture.
2. **Steel stators for strength.**
3. **Thirteen-step winding treatment,** for maximum stator protection.
4. **Pressure cast aluminum rotors** provide trouble-free windings.
5. **Heavy shafts,** liberally designed for added strength.
6. **Precision bearing mount** affords *real* protection to bearings and windings.
7. **Optional lead outlet arrangement** permits machine mounting with elimination of conduit box.
8. **Flange and face type brackets** offer alternative methods of machine application.

Write today for Bulletin C-118 which gives more complete details on these 8 advantages and offers many additional reasons why it will **pay you** *to specify Reliance Series C Motors.*

RELIANCE ELECTRIC & ENGINEERING CO.

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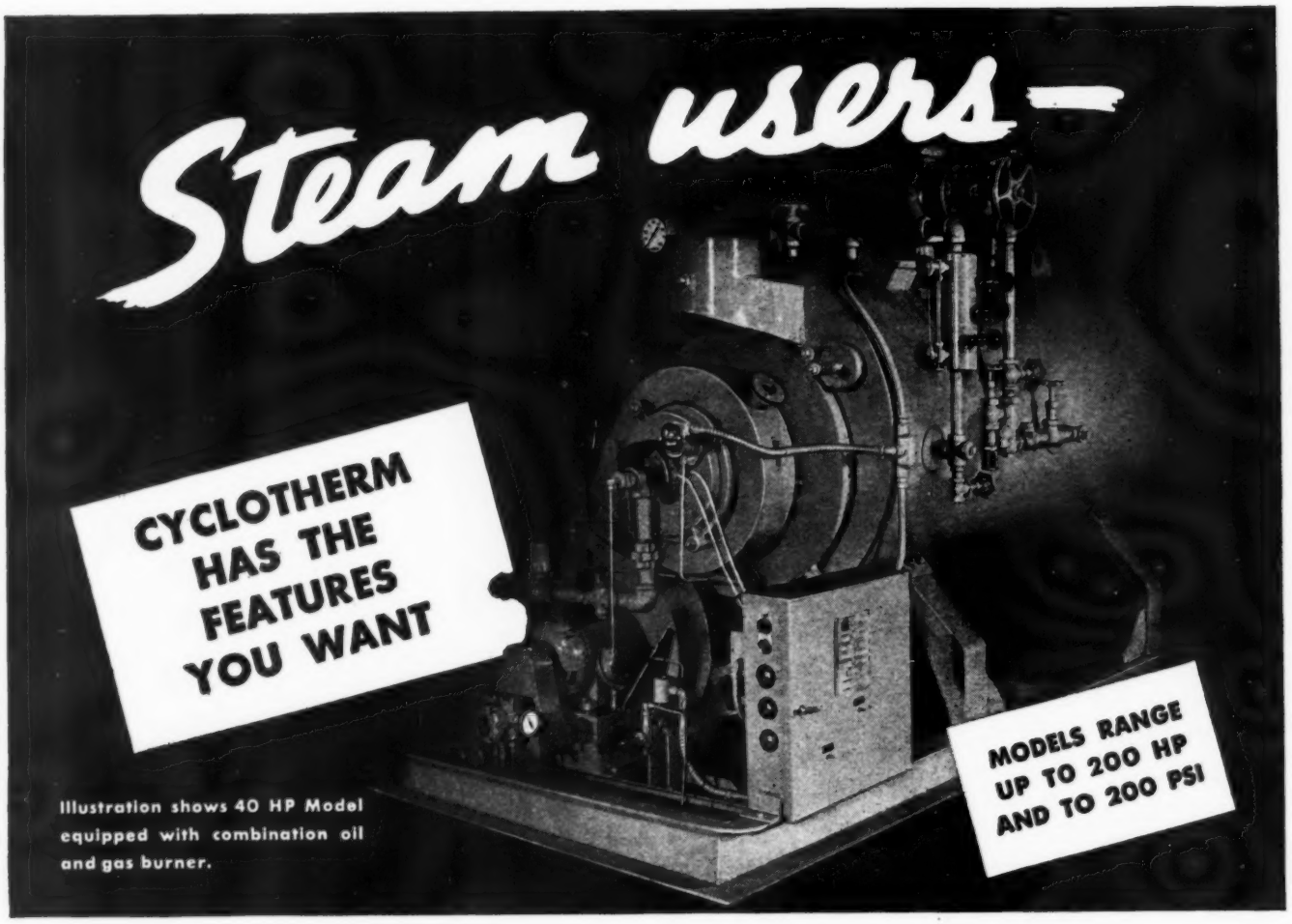
RELIANCE A-C D-C MOTORS


Steam users—
CYCLOTHERM HAS THE FEATURES YOU WANT
MODELS RANGE UP TO 200 HP AND TO 200 PSI
Illustration shows 40 HP Model equipped with combination oil and gas burner.

Cut your Steam Costs with a Cyclotherm

Steam costs, from fuel to boiler maintenance drop when you install a Cyclotherm Steam Generator.

Cyclotherm's completely automatic operation and exclusive principle of combustion and heat transfer maintain better than 80% operating efficiency, assure thrifty control of fuel consumption and a minimum of operating expense.

Choice of Oil or Gas Firing

In some areas it is desirable to use either oil or gas as fuel. The Cyclotherm model illustrated above is equipped with the Cyclotherm combination gas-oil burner permitting the change-over from one fuel to the other by merely throwing a switch.

Use of Heavy Oil and Wide Range Modulation

Cyclotherm units from 80 to 200HP may be fired with heavy oil. These units may also be equipped with combination burners, firing either heavy oil or gas. Special automatic controls modulate the firing rate from 30% to 100% of fuel load in response to steam demands.

Shipped as Complete Unit

Cyclotherm units are shipped complete with boiler, burner, all accessories and controls assembled; fully piped, wired; test fired and ready to operate on arrival. They are compact and space saving, and require no special base.

Thousands of Cyclotherm Steam Generators have been proved in use by our armed forces all over the world. Their splendid record of efficient performance indicates the engineering "know-how" and stamina built into each unit.

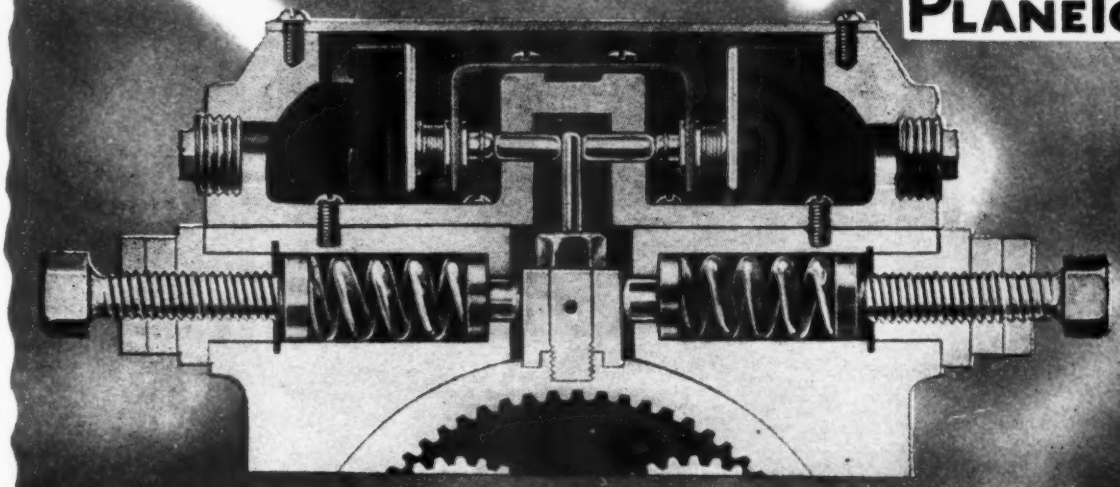
Write, wire or phone for more complete information.

CYCLOTHERM STEAM GENERATORS

CYCLOTHERM CORPORATION, 90 BROAD STREET, BOX 602, NEW YORK 4, N. Y.

Like Magic

PLANETORQUE



automatically and positively
GIVES OVERLOAD PROTECTION
to driven machinery and
MOTOREDUCER .. *instantly*

The "exclusive" Philadelphia **Planetorque** is a feature that can be incorporated into any Philadelphia **MotoReduceR** (as seen from the illustrations herewith).

By direct *mechanical actions* of the overload, the motor current is *automatically* and *instantly cut-off as soon as a predetermined load limit is reached.* This action is *quicker* and *more positive* than electrical thermal relays. With "fuse protection," the fuses must be selected to carry the starting current of motors; therefore, protection during the running period is not adequate. Incidentally, the **Planetorque** can be cut out during the starting period, by merely holding down the starting button, and upon release of said button it becomes operative again during the running period. To restart the **Planetorque** after it has cut-off from dangerous overload, merely remove the excessive load—a big time-and money-saving feature.

The **Planetorque** is ideal for Stoker drives, Crushers, Mixers, Rolls, Pulverizers and a "hundred and one" other machines. Write for Catalog MR-45.

Showing a Philadelphia Horizontal **MotoReduceR** with the small, simple, neat **Planetorque** installed.

Philadelphia
GEAR WORKS INCORPORATED

ERIE AVE. AND G ST., PHILADELPHIA 34, PA. NEW YORK • PITTSBURGH • CHICAGO
IN CANADA: WILLIAM & J. G. GREEY LIMITED, TORONTO.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

SAVE 3 WAYS with Tube Couplings by PARKER

You'll save at every stage with Parker Tube Couplings. Here's why:

INSTALLATION is simplified—because the parts are self-aligning—and completely interchangeable, too.

OPERATION with Parker Couplings will give you sustained, trouble-free service. The famous patented design insures a pressure-tight, leakproof, vibration-protected joint.

MAINTENANCE is a routine matter, easily accomplished—even in tight spots. You can disassemble a Parker Coupling so fast that servicing requires only a few minutes of down time.

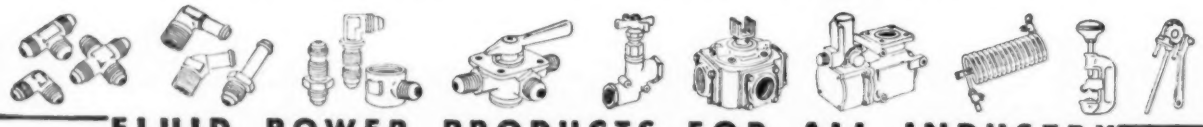
★

Parker Couplings are available in a wide variety of types—in steel, brass, stainless or aluminum—and in sizes from ⅛" to 1½", standard or heavy weight. You'll find complete information in our new catalog 201-C—yours for the asking, from your jobber—or write direct to The Parker Appliance Company, 17325 Euclid Avenue, Cleveland 12, Ohio. In Canada, Railway & Power Engineering Corporation, Ltd., Montreal, P. Q.

★

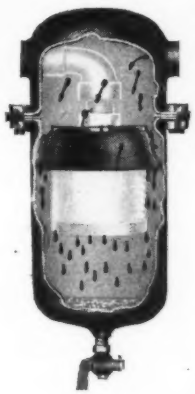
THE PARKER APPLIANCE CO.

CLEVELAND • LOS ANGELES



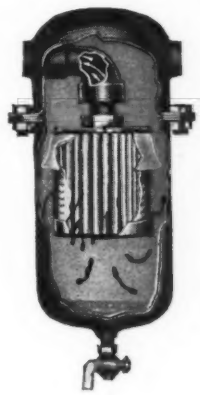
FLUID POWER PRODUCTS FOR ALL INDUSTRY

EXCLUSIVE *DOUBLE ACTION PRINCIPLE* GUARANTEES BOTH CLEAN AND DRY AIR



1. MECHANICAL SEPARATION

Deflector cup directs flow of air or gas together with water, oil and dirt to the walls of the housing and thence downward at high velocity into the base where liquid and heavier dirt particles are deposited.



2. FILTRATION

Air or gas, having been mechanically cleaned, rises at low velocity through the Radial Fin Filtering element or insert which removes the lighter airborne material.

The popularity of Staynew Double Action Pipe Line Filters increases as manufacturing tolerances decrease—as vanes and pistons are closer fitted, orifices are made smaller, machines in general are built to more precise limits and processes are more scientifically controlled. Inexpensive, quickly installed and easily maintained, these filters provide highest filter efficiency with low overall maintenance.

IMPORTANT APPLICATIONS

Protection of Air-operated Tools ★ Paint Spray ★ Sand Blast ★ Air Displacement of Liquids ★ Air-operated Instrument Controls Liquid Agitation

COMPLETE DATA ON REQUEST

DOLLINGER CORPORATION

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

23 CENTRE PARK ROCHESTER 3, N. Y. REPRESENTATIVES IN PRINCIPAL CITIES

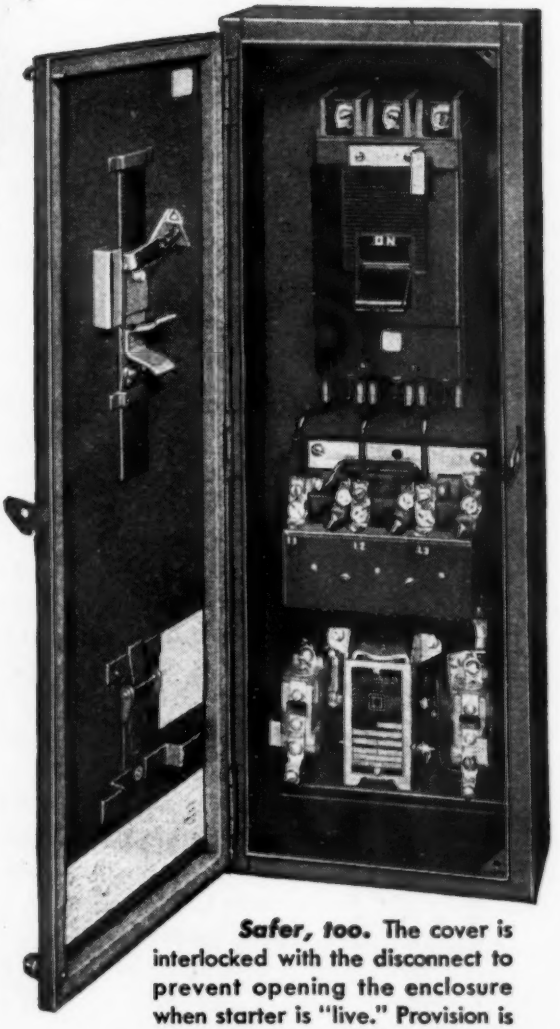
MORE THAN 1,000,000 STAYNEW PIPE LINE FILTERS SOLD TO INDUSTRY

Square D Front-operated Combination Starters

● You save time by using combination starters. Since the disconnect (switch or breaker) and the magnetic starter are housed in one enclosure, you cut mounting time in half and also save wiring time.

A combination starter takes less space than two separate devices. These Square D front-operated units save still more space. They are especially suitable for "ganging."

Square D front-operated starters are available in three capacities—sizes 0, I, and II. Some types of larger sizes are side-operated. For informative bulletin, address Square D Company, Industrial Controller Division, 4041 North Richards St., Milwaukee 12, Wis.



Safer, too. **The cover is interlocked with the disconnect to prevent opening the enclosure when starter is "live." Provision is also made for padlocking the disconnect in the "OFF" position.**

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

...one of **many** Edge Moor Types

Edge Moor vertical flow Bent Tube Boiler...

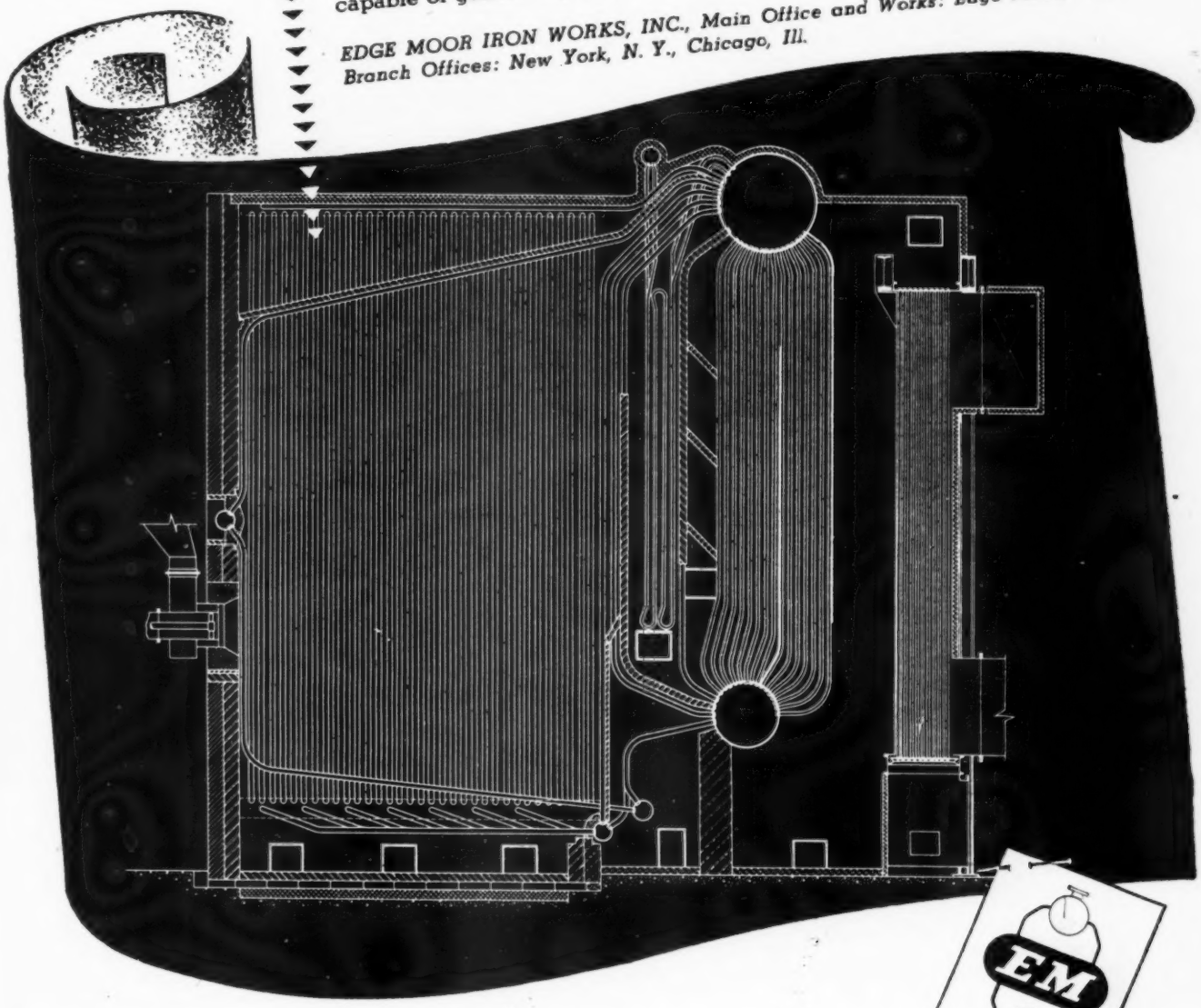
• Edge Moor boiler design is and always has been flexible. No single type will furnish steam under all circumstances and requirements as satisfactorily and economically as a boiler adapted to those requirements and conditions.

• The Edge Moor Vertical Flow Boiler is designed for maximum output in a limited space. It is a combination of a simple two-drum boiler bank, having perfect U-tube circulation, and a water cooled furnace, integral with the boiler. The large amount of surface exposed to radiant heat results in a quick steaming unit that will give rapid response to load changes.

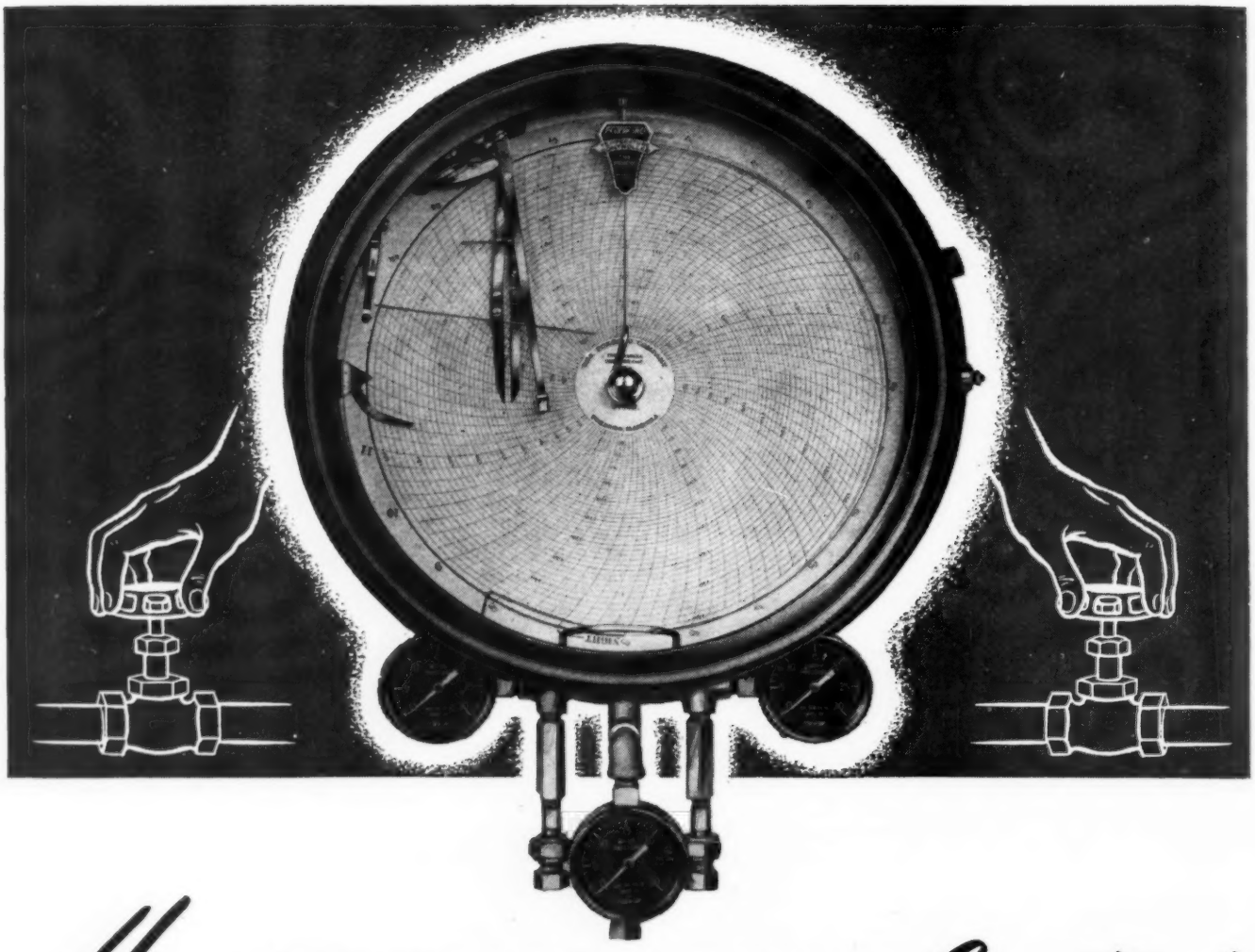
• The Edge Moor Vertical Flow Boiler is adaptable to all methods of firing both solid and liquid fuels. It is available in sizes from the smallest to units capable of generating 200,000 lbs of steam per hour.

EDGE MOOR IRON WORKS, INC., Main Office and Works: Edge Moor, Del.
Branch Offices: New York, N. Y., Chicago, Ill.

Edge Moor Vertical Flow Unit with Edge Moor Superheater and tubular Air Preheater; arranged for pulverized coal firing.



EDGE MOOR Steam Generating Equipment



Here's "AMBIDEXTROUS" *Control*

THAT AUTOMATICALLY OPERATES TWO VALVES!

Wherever process temperature, pressure or humidity must be controlled by adjustments of two valves, the Foxboro Duplex Controller gives you two dependable, accurate "hands" that need no supervision. It combines 2 single-action valve control systems actuated by a single measuring system.

All you need to do is set the "high" and "low" indicators at desired points. The controller automatically "manipulates" one valve if the process condition reaches the high point; or the other valve at the low point.

What's more, both adjustments may be definitely fixed at specified degrees, percentages, or pounds-per-square-inch to maintain an exact differential between high and low points.

Typical advantageous uses of Foxboro Duplex Controllers are listed in the panel. Detailed information on their application to your problem may be obtained by sending a description of your process. Write **The Foxboro Company, 68 Neponset Ave., Foxboro, Mass., U. S. A.** Branches in principal cities.

TYPICAL APPLICATIONS

1. Dry Kilns – for humidity control. One "hand" of the Duplex Controller operates steam spray valve; the other adjusts the vent.

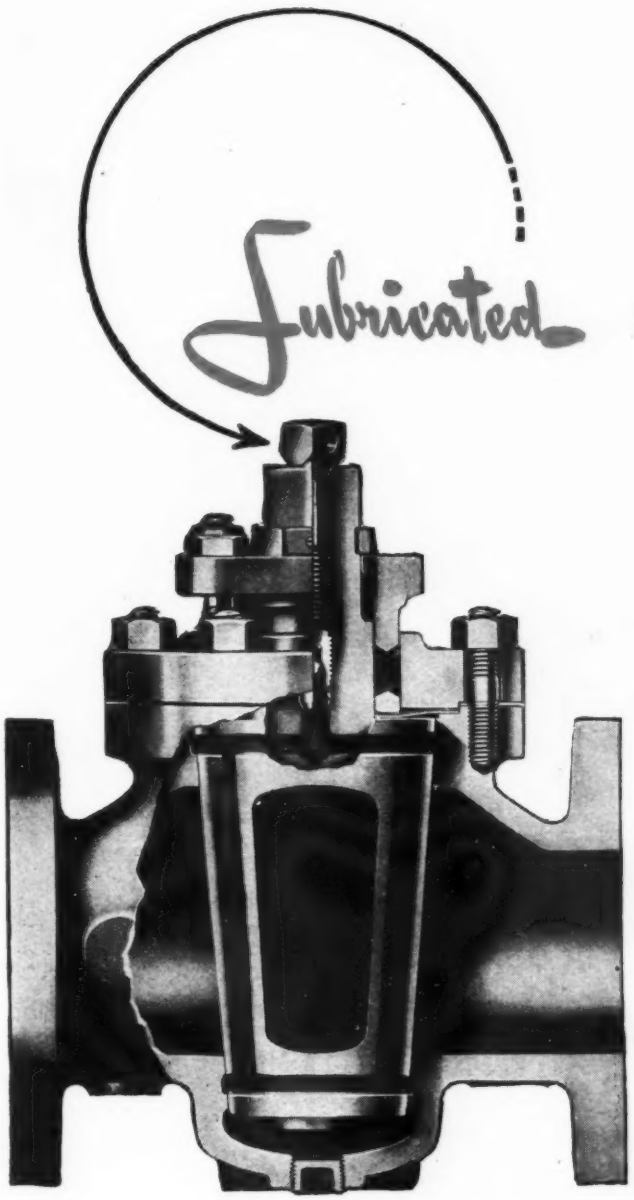
2. Air Conditioning – without supervision, a Duplex Controller accurately controls heating and cooling, or humidifying and de-humidifying.

3. Dryer Rolls (as in paper mills) – Foxboro Duplex Controller automatically controls two valves to utilize exhaust steam or live steam for greatest economy and uniform temperature.

4. Exothermic Processes, such as electroplating and polymerizing. Through accurate control of 2 valves, Duplex Control automatically adds or removes heat to maintain correct temperature.

FOXBORO
REG. U. S. PAT. OFF.

DUPLEX CONTROLLERS



The lubricant grooving system built into Walworth Lubricated Plug Valves is the very heart of the valve. At all times it assures easy operation . . . fast action . . . tight shut-off . . . greater protection against corrosion.

FOR TIGHT SHUT-OFF . . . EASY OPERATION

Passageways are provided so that when the lubricant screw is turned, lubricant is forced from the lubricant chamber through these passageways which carry the lubricant to lubricant grooves in the seating surfaces. These grooves completely surround the ports and the resistant lubricant with which they are filled seals against leakage.

Walworth Lubricated Plug Valves are available in sizes ½" to 24" for pressures from 125 to 5,000 psi, and for vacuum requirements. These valves are being used successfully on lines carrying gases, air, water, oil, gasoline, chemicals, acids, solvents, and so on. For further information about Walworth's complete line of lubricated plug valves, write for Catalog No. 44L.

Walworth VALVES AND FITTINGS

60 EAST 42nd STREET, NEW YORK 17, N. Y.

• DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Two 600 hp, four 300 hp, and two 150 hp, E-M Magnetic Drives operate draft fans at the Port Washington, Wisc., and Commerce Street, Milwaukee plants of Wisconsin Electric Power Co.

Magnetic Drive . . .

Makes Boiler Draft Fans

PERFORM BEST!

● A simple, compact electro-magnetic torque-transmitter, the E-M Magnetic Drive provides the modern method of regulating the output of mechanical draft fans. Installed between a squirrel-cage or synchronous motor and the fan, operating in combination with automatic draft control, the Magnetic Drive provides wide-range, micro-step, adjustable speed for fan output control. *Adjustable speed control* of both forced and induced draft

fans with the Magnetic Drive provides important advantages: (1) Lower power consumption; (2) Reduced fan erosion; (3) Precise, wide-range control of fan output; and (4) Quieter, smoother operation!

WRITE FOR FACTS AND PICTURES ABOUT THE . . .

MAGNETIC DRIVE

This 16-page, 3-color, booklet describes Magnetic Drive construction, operation, and advantages; performance curves, diagrammatic cross-sections, illustrations of Magnetic Drives in use. Write for your free copy today.

ELECTRIC MACHINERY MFG. COMPANY

MINNEAPOLIS 13, MINNESOTA

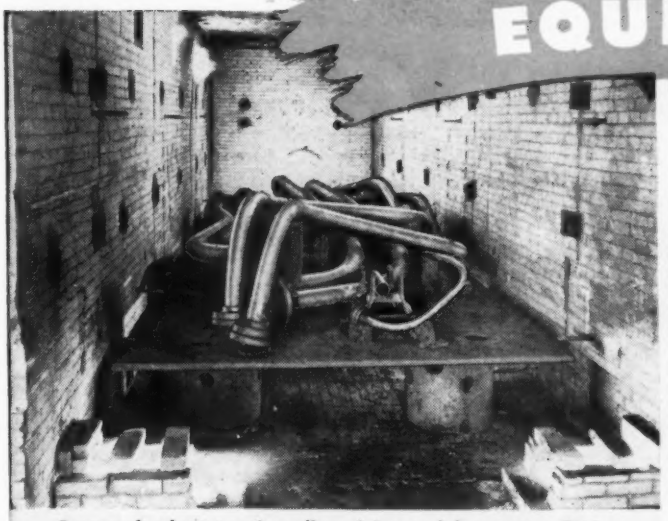
E-M

Adjustable-Speed MAGNETIC DRIVES

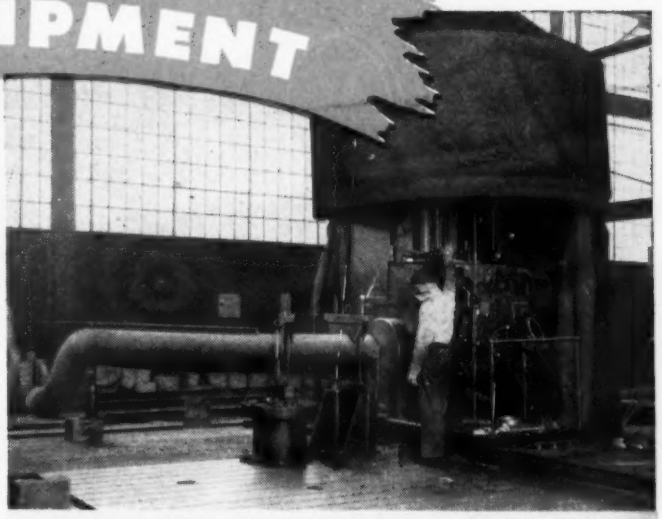
A-2021

Modern Pressure Piping Requires

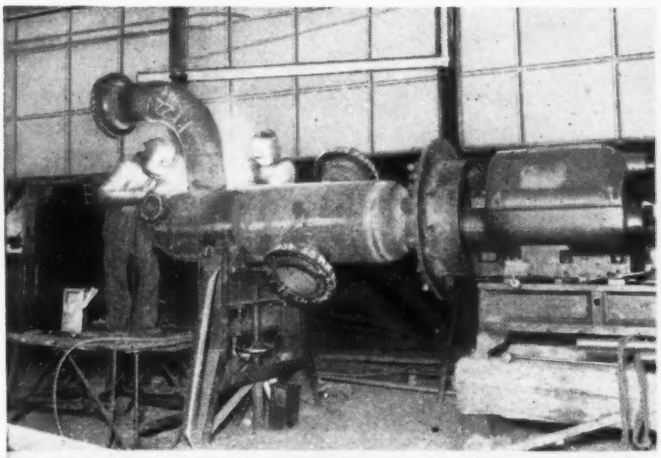
MODERN SHOP EQUIPMENT



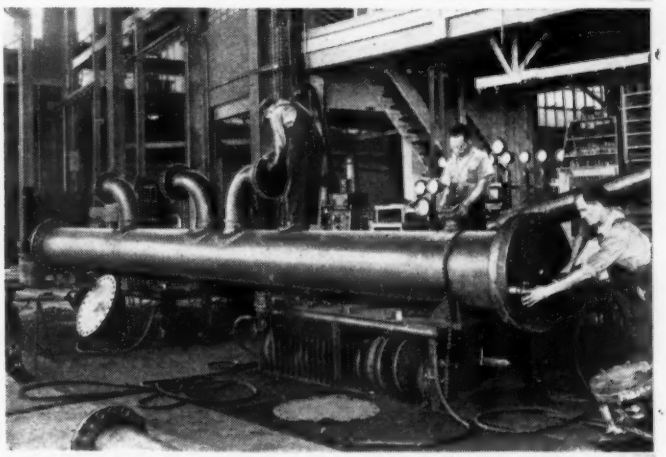
Furnace for heat treating alloy piping and for stress relieving shop-welded subassemblies.



Modern machine tools are used by the qualified fabricator for the accurate facing of pre-fabricated piping.



Special work rotating equipment permits pressure welding under the most favorable conditions.



Adequate testing equipment is another important advantage of the qualified pipe fabricator.

Knowing that "the workman is no better than his tools," qualified pipe fabricators have equipped their plants with many facilities that are not usually available in the field, but that are essential to the proper fabrication of modern pressure piping. Included are layout tables, bending equipment, form cutting machines, rotating fixtures and jigs for welding, special machine tools, preheating and stress relieving equipment, straightening tables, special testing equipment, etc. These facilities represent an enormous investment and are necessary to assure the high quality, speed, economy and easy installation of pre-fabricated pressure piping.

Pre-fabricated piping is delivered to the job as a series of subassemblies with all difficult operations performed. These subassemblies are commercially practical, heat treated and stress relieved when necessary, shop tested, accurately aligned, thoroughly cleaned and inspected. Erection requires a minimum of time and labor . . . the finished job is better piping.

THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

P.F.I. THE PIPE FABRICATION INSTITUTE G-1

1108 CLARK BUILDING • PITTSBURGH, PA.

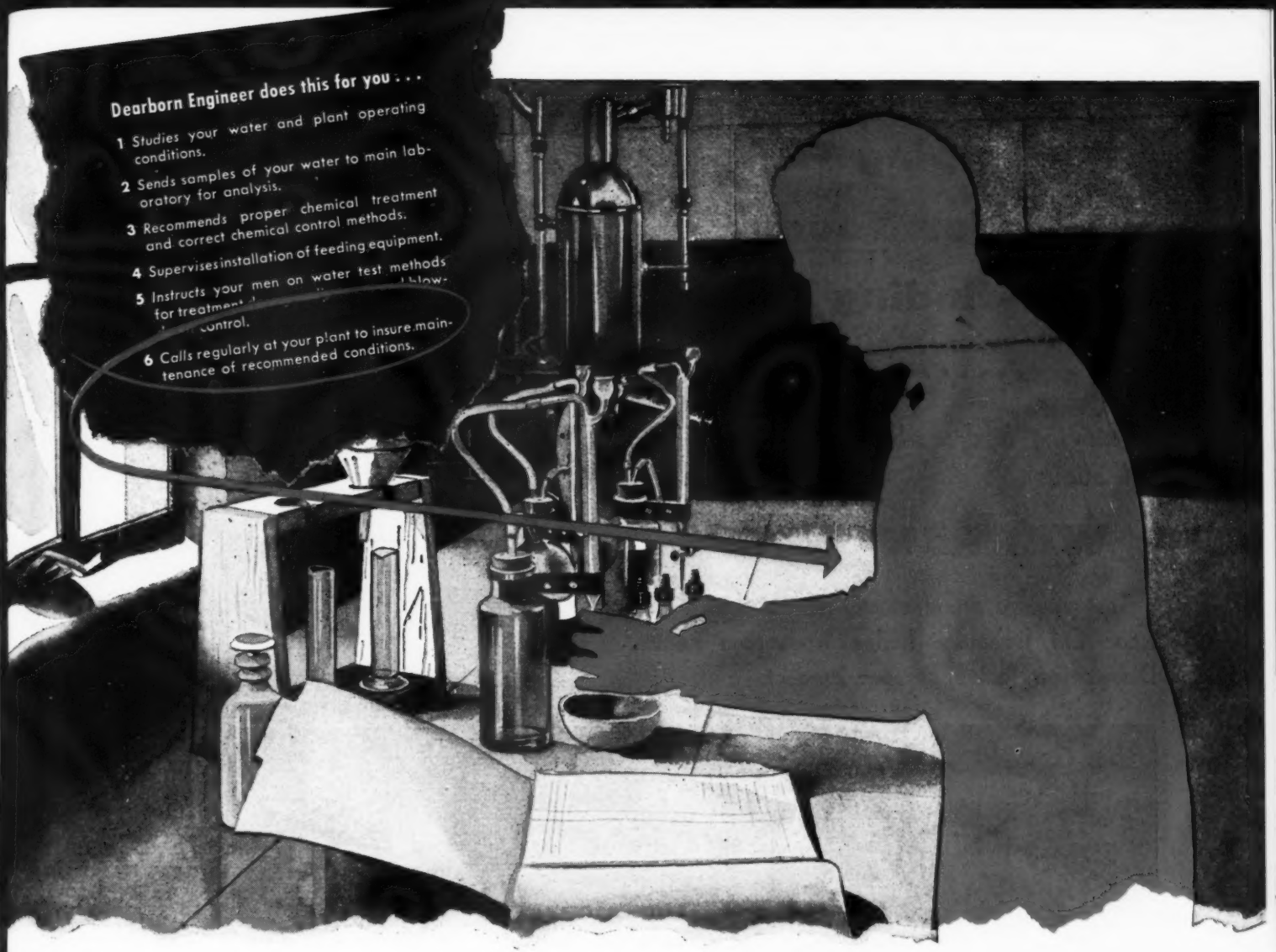
CP Oil-less Cylinder Compressors have been developed for use where the air or gas compressed must be free from oil. No oil, grease or other cylinder lubricant is required. Piston and rod, completely supported by crossheads, are full floating, removing all weight from cylinder walls and stuffing boxes, thereby avoiding wear of carbon piston rings and hardened steel cylinder liner. Trouble-free operation and long life of wearing parts are assured. Only normal maintenance is required — no need for periodic rotation of piston rings.

CP Oil-less Cylinder Compressors are arranged for belt, motor or steam drive, in single stage and two-stage types. They are available in a wide range of sizes and ratings. Write for complete information.

★★★★★★★★★
PNEUMATIC TOOLS
ELECTRIC TOOLS
HYDRAULIC TOOLS
ROCK DRILLS

CHICAGO PNEUMATIC
TOOL CP COMPANY
General Offices: 8 East 44th Street, New York 17, N. Y.

★★★★★★★★★
AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES


Dearborn Engineer does this for you . . .
1 Studies your water and plant operating conditions.
2 Sends samples of your water to main laboratory for analysis.
3 Recommends proper chemical treatment and correct chemical control methods.
4 Supervises installation of feeding equipment.
5 Instructs your men on water test methods for treatment
control.
6 Calls regularly at your plant to insure maintenance of recommended conditions.

. . . IT'S THE Continuing Service

THAT NIPS WATER TROUBLE IN THE BUD

When trouble due to water conditions raises its head, Dearborn treatment applied under the skilled direction of Dearborn Engineer nips it in the bud.

Service does not stop with the first treatment application. Dearborn Engineer calls regularly to assist with maintenance of the balanced treatment program.

The type and amount of reagents required to properly condition your boiler water have been previously determined by a study of your plant operating conditions, water analyses, and final formulations by Dearborn laboratories.

Keeping boilers in good physical trim is naturally under the watchful eyes of *your own* men. When Dearborn Engineer co-operates with them . . . month after month . . . you're doubly assured of top steaming efficiency.

Dearborn Chemical Company
Dept. D, 310 S. Michigan Ave., Chicago 4, Illinois.

Dearborn
TRADE MARK REGISTERED

THE LEADER FOR OVER HALF A CENTURY
ENGINEERING SERVICE AND WATER TREATMENT

Pumping Facts for Your Fact-finding Board

If moving hydrocarbons is your problem ask about

WARREN PUMPS

These pumps are efficiently handling Rich Oil, Lean Oil, Isobutane Reflux, Isopentane Reflux, Debutanizer Reflux, Finished Product.

Other Warren Pumps are used for Steam Condenser Circulating, Cooling Tower Water, Compressor Jacket Water . . . and among the facts definitely proven by experience is that dependability and longer life, plus minimum maintenance, is the type of round-the-clock performance consistently turned in by Warren Pumps at this modern plant.

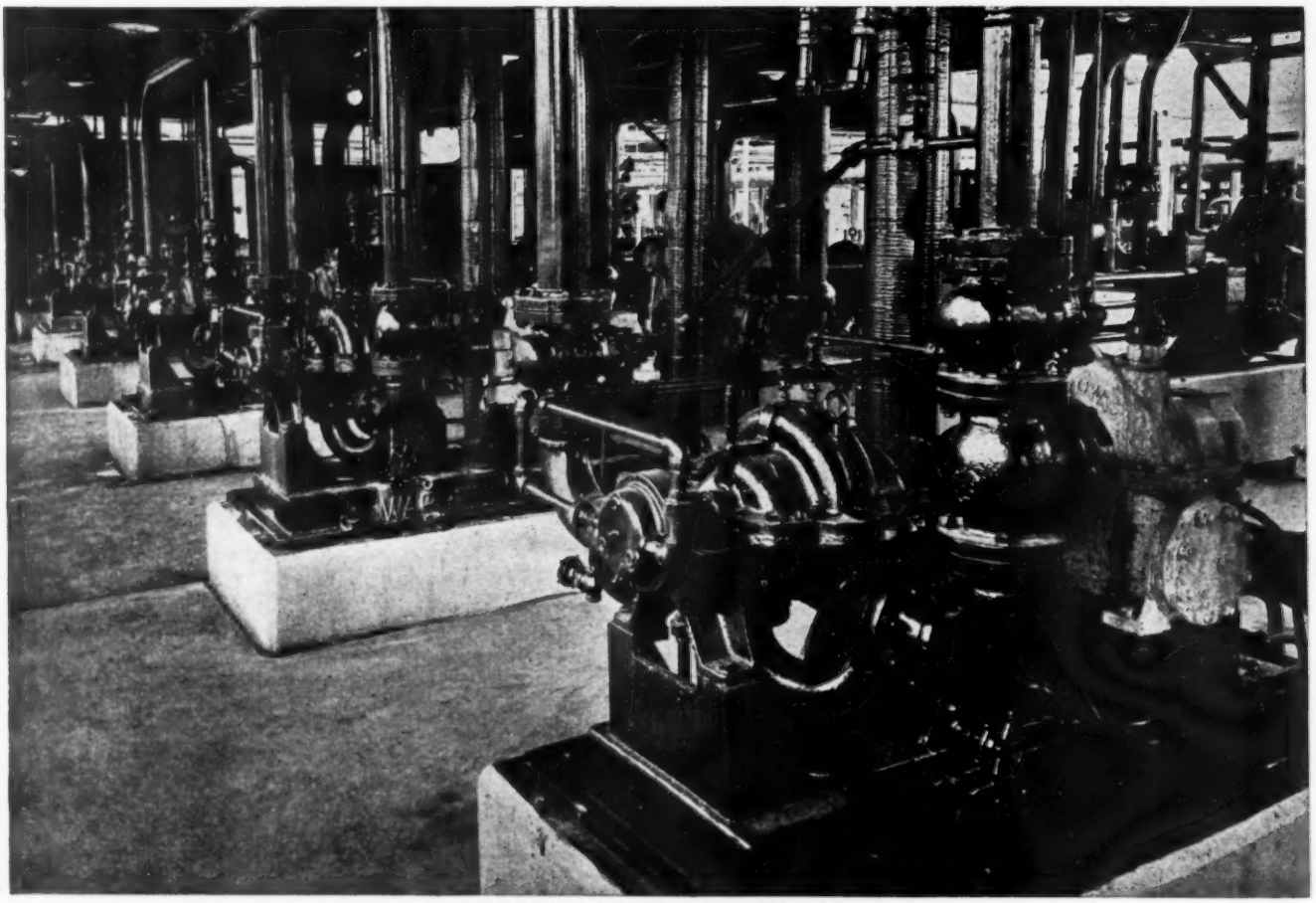
Countless other fact-finding reports tell the same story and are conclusive evidence of what you can reasonably expect from all types of Warren installations.

Inquiries solicited.

WARREN STEAM PUMP COMPANY, INC.
WARREN, MASSACHUSETTS

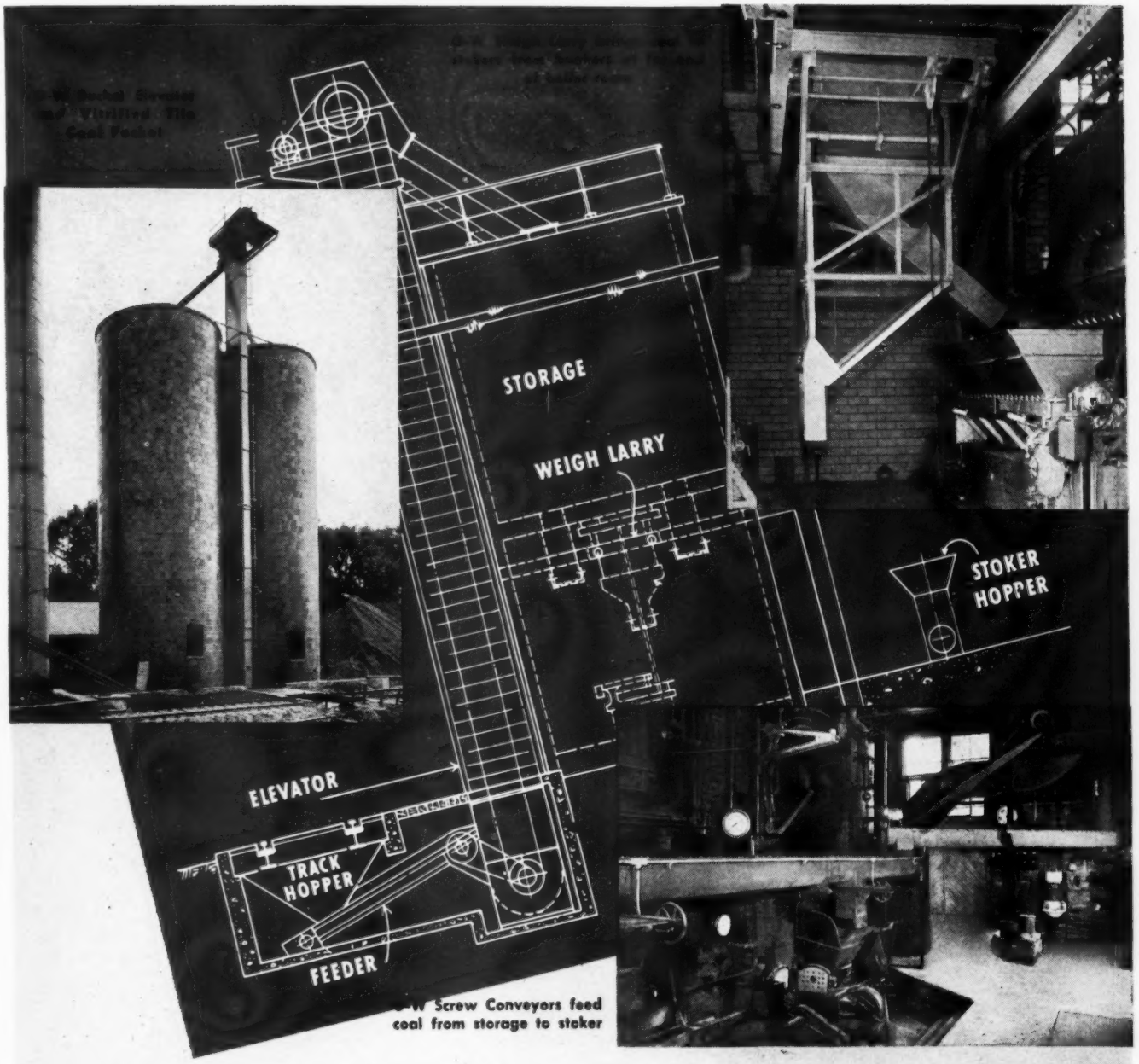
Atlanta Boston Chicago Cleveland Detroit Houston Hartford
Indianapolis Los Angeles Minneapolis New Orleans New York
Philadelphia Pittsburgh Richmond San Francisco Seattle

P-3



WARREN PUMPS HANDLING HYDROCARBONS

WARREN PUMPS



G-W Screw Conveyors feed coal from storage to stoker

This One Coal-Handling System ADAPTABLE to many needs

This *typical* G-W coal handling system has been erected many times (with but slight modifications) to meet widely varying conditions in specific boiler plants. Vitrified tile or concrete storage silos—filled from track hopper by bucket elevator—coal transported from storage to stokers by weigh larry or screw conveyor.

G-W does the job from design to finish—shoulders all details—assumes all responsibilities. G-W has specialized in this *complete service* for 130 years. Get a G-W engineer to study your needs. Gifford-Wood Co., 420 Lexington Ave., New York 17; 565 W. Washington St., Chicago 6 – Factory: Hudson, N. Y. Write Dept. P.

1235

G-W HANDLES IT...
faster • easier • cheaper

Gifford-Wood

SINCE 1814

MAKING AN IDEAL A REALITY

The ideal of The Otis Elevator Company for many years has been to provide the best and safest elevator transportation possible. To insure uniformity and the best results, each piece is manufactured by us under strict supervision; and the complete elevator is then installed by trained Otis mechanics.

Only one thing more has been necessary to make this ideal a reality, and that is a service which undertakes to maintain the completed elevator in the same fine condition in which it was when installed.

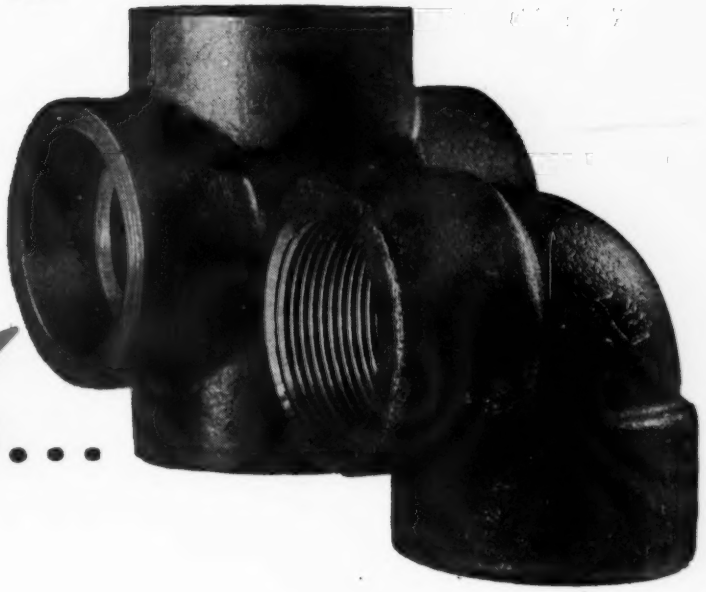
It is possible for owners of Otis elevators to contract directly with us, as manufacturer, for complete maintenance, to keep Otis elevators in the best condition, and preserve the elevator investment intact.

OTIS ELEVATOR COMPANY

Offices in all principal cities

Put 'em in and forget 'em!

WATSON-STILLMAN FORGED STEEL FITTINGS . . .



W-S forged steel socket welding or screw end fittings, once installed, can be forgotten, because they are made to give years of leak-proof and trouble-free service.

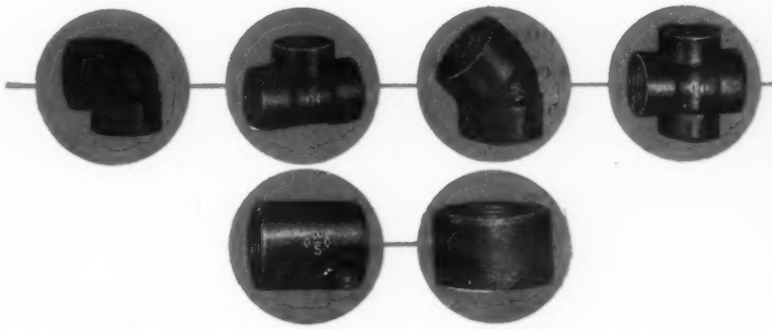
Especially recommended for high pressure, high temperature service in refineries, oil fields, chemical plants, ship construction, air conditioning and refrigeration, power plants and hydraulic installations.

Socket welding fittings available for use with Schedules 40, 80, 160 and double extra strong pipe.

Screw end fittings available in three classes, 2000 lb., 3000 lb. and 6000 lb.

Each type can be furnished in carbon steel, carbon molybdenum steel, chromium molybdenum steel, or various types of stainless steel.

WATSON - STILLMAN CO.
ROSELLE • NEW JERSEY
Sold Through Leading Distributors



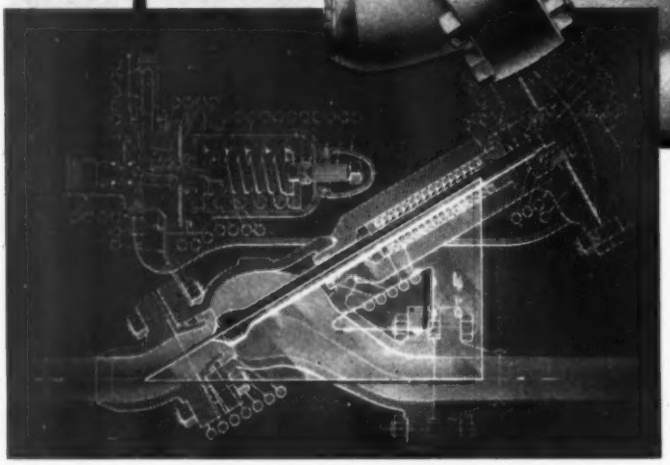
WATSON-STILLMAN
DISTRIBUTOR PRODUCTS DIVISION

1820

Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

Maximum Flow . . .

WITH FREEDOM FROM FREEZING



Representing a radical and marked advancement in Valve design the New Grove S-FLO Valves provide the solution to troublesome problems in Black Pressure, Relief and Stack Valve Service.

Maximum free-flow characteristic results from unique 30° S-pattern valve body design, which eliminates turbulence. This, plus even-flow distribution at the inlet, and direct downstream discharge and flow expansion contributes to eliminate wire-drawing, cutting and freezing. Single seated Valve and Pilot construction insures positive tight shut-off further precluding freezing caused by continuous seepage. Being fully self-contained and self-operating at flow line pressures, these units function freely on line fluid at flow line pressures, thereby avoiding secondary pressure reductions and resulting waste.

* FREE FLOW CHARACTERISTIC
* SMOOTH NON TURBULENT OPERATION
* MAXIMUM FLOW CAPACITY
* AVOIDS STICKING & FREEZING
* SELF-CONTAINED
* SELF-OPERATING
* STOPS LEAKAGE HAZARDS
* NO PACKING GLANDS
* EXTREME CONTROL ACCURACY
* MINIMUM CUTTING ACTION

BACK PRESSURE, RELIEF AND STACK VALVE SERVICE

GROVE S-FLO VALVE

MODEL 53

Write for Bulletin #500 TODAY!

GROVE REGULATOR COMPANY

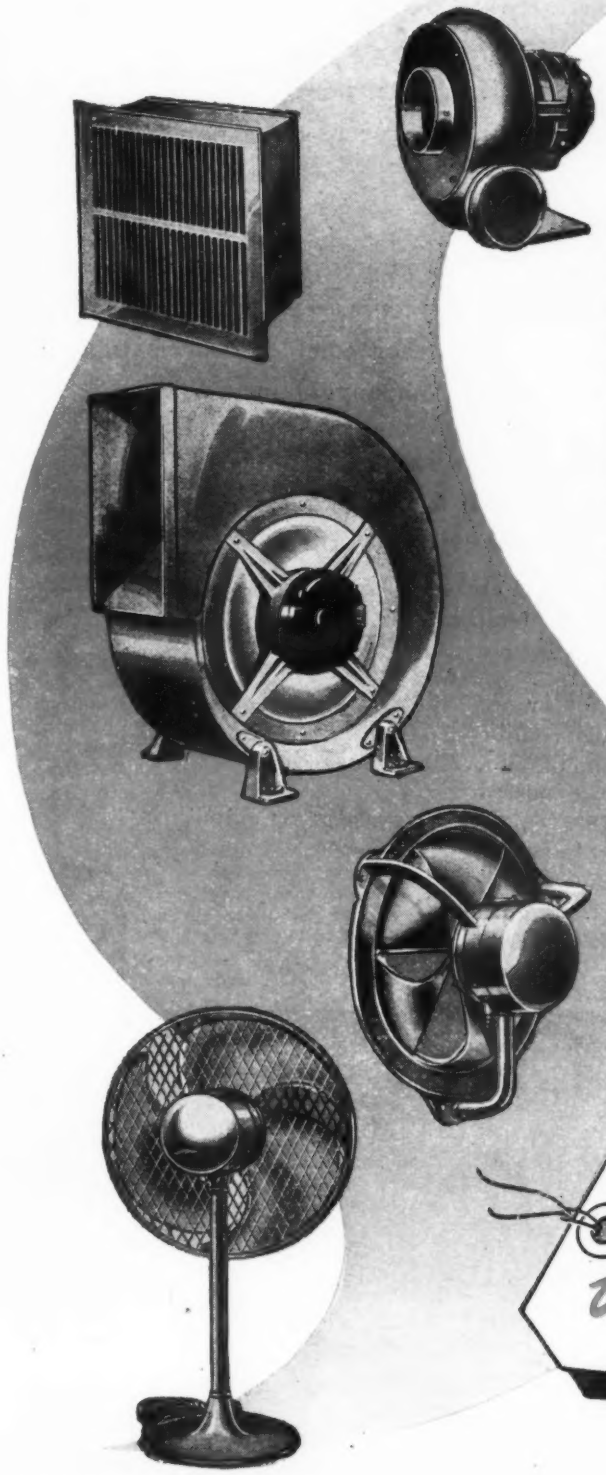
1190-67TH STREET • OAKLAND 8, CALIFORNIA

EASTERN SALES AND EXPORT OFFICE: 30 ROCKEFELLER PLAZA • NEW YORK CITY, N. Y.

FACTORY BRANCH: 108 PORTWOOD, HOUSTON, TEXAS • 1930 W. OLYMPIC BLVD., LOS ANGELES.

Ventilation

FOR YOUR PLANT OR PRODUCT



GRAYBAR OFFERS ILG BLOWERS, PROPELLER FANS, ACCESSORIES . . . APPLICATION AID

Whether you want to remove fumes, dust, heat, or stale air from a single room — or ventilate your entire building—or incorporate a ventilating unit into your product, you'll find suitable apparatus in the popular Ilg line which Graybar distributes. You or your electrical contractor will find, too, that the Graybar Specialist in your vicinity can be of substantial help in planning the ventilating system which will meet your requirements most efficiently and economically.

Other Graybar Specialists — in wiring, lighting, communication, and power apparatus — are always on call to help solve any of your electrical problems. Though today we may not have in stock all the equipment, supplies, and tools you require — hundreds of electrical items *are* quickly obtainable from our near-by warehouse right now. We'll gladly keep you posted concerning others. Call our nearest office. *Graybar Electric Company. Executive offices: Graybar Building, New York 17, N. Y.*

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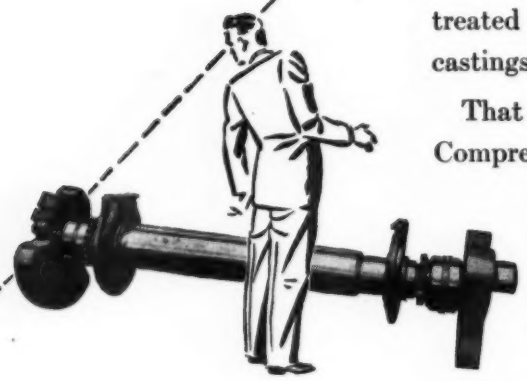
IN OVER 90 PRINCIPAL CITIES

Everything Electrical via GraybaR



You can learn a lot about a compressor from its crankshaft!

Here is the main crankshaft of a Gardner-Denver Class "HA" Horizontal Air Compressor. Notice those Timken roller main bearings—an exclusive Gardner-Denver feature. The shaft is a steel forging, heat treated and finished all over. The crank discs are steel castings and counterweights are cast integral.

That crankshaft tells you a lot about an "HA" Compressor—because it is typical of the kind of construction used throughout. That's why the "HA" is a *heavy-duty* compressor in every sense of the word. That's why it gives year after year of continuous service—24 hours a day if you like—with a bare minimum of maintenance.

If you're looking for a compressor that's a standout for service—and a miser on costs—let us tell you more about the "HA". For complete information, write Gardner-Denver Company, Quincy, Illinois.

OTHER "HA" FEATURES

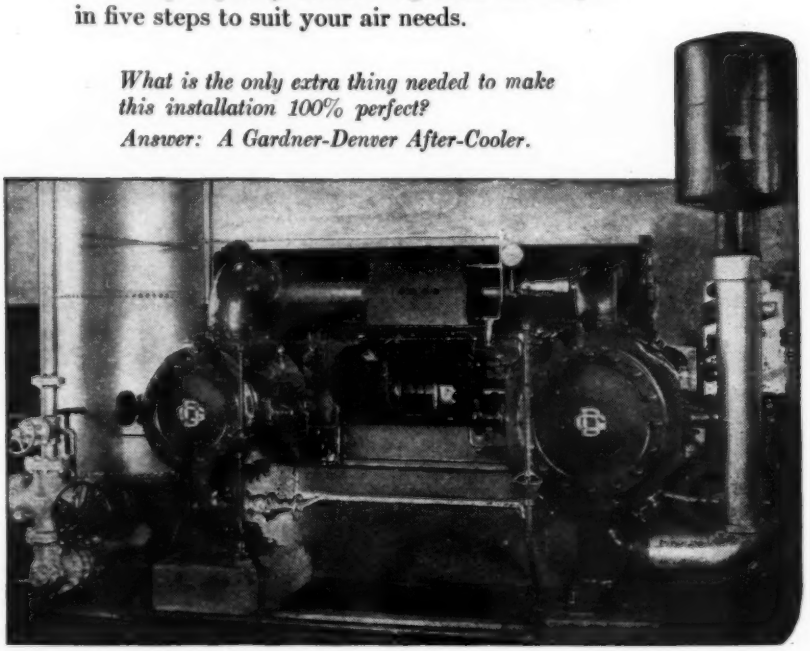
- Air cylinders designed for highest volumetric efficiency and lowest horsepower requirements.
- Large water jacket areas for cooler-running . . . lower discharge temperatures and lubricating economy.
- Duo-plate "cushioned" valves for high delivery capacity, high compression efficiency and lowest power consumption.
- Five-step capacity control regulates air output in five steps to suit your air needs.

GARDNER-DENVER

Since 1859

USE COMPRESSED AIR FOR SAFETY CONVENIENCE FLEXIBILITY

What is the only extra thing needed to make this installation 100% perfect?
Answer: A Gardner-Denver After-Cooler.



Gardner-Denver Class "HA" Two-stage Horizontal Compressor. Available in capacities from 316 to 2012 cubic feet displacement per minute.

One basic change has

REVOLUTIONIZED ZEOLITE WATER SOFTENING

Here's what the new Elgin means to you-

Most plants need more soft water—

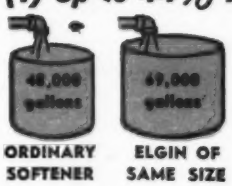
Too often the use of soft water begins and ends in the boiler room. But the extra amount of soft water that costs so little more in the big-output Elgin "Double-Check" Softener permits many uses of soft water that are highly profitable through cutting labor costs, improving processes and reducing maintenance costs. Throughout the hot water system, zero-soft water eliminates scale and lime deposits in tanks, heaters and piping, cutting plumbing costs. In all plant cleaning operations it does a better, faster job with a big saving of soap and cleaning compounds. In many plant processes Elgin "zero-soft" water improves the quality of finished products and where jacketed equipment is involved it increases operating efficiency and cuts maintenance cost.

Where corrosion is a problem, Elgin anti-corrosion treatment gives complete protection.

**** Your present softener, regardless of make, can be modernized by Elgin to incorporate the features and advantages of the Elgin "Double-Check" Softener. The new bulletin explains this.***

When we say the Elgin "Double-Check"* method has revolutionized the zeolite water softener, we simply state a fact that is confirmed by more than 3,000 of these softeners now in service. Users acclaim it; operating records confirm it! Here briefly is what the "Double-Check" Softener means to you:

(1) Up to 44% more soft water: By preventing escape of zeolite, the "Double-Check" manifold system permits utilizing a zeolite bed far deeper in proportion to the size of the softener. Likewise, by preventing escape of zeolite, a higher back-washing rate is made possible. The zeolite is kept clean and active, thus more zero-soft water is produced per pound of salt. For example, a 48″ x 72″ Elgin, softening ten-grain water, delivered 21,000 gallons more soft water per regeneration than a conventional softener of identical size.



(2) Costs less—*to buy, operate, maintain.* Based on gallons delivered the initial cost of the Elgin is lower. The "Double-Check" distributing and collecting system means less regenerating salt and wash water. Elgin quality means longer life; lower maintenance.

(3) Requires less space. The diagram tells it. This is often a vital consideration.

New bulletin *tells the convincing "Double-Check" story.* State whether you want the general power plant, laundry or hospital edition.

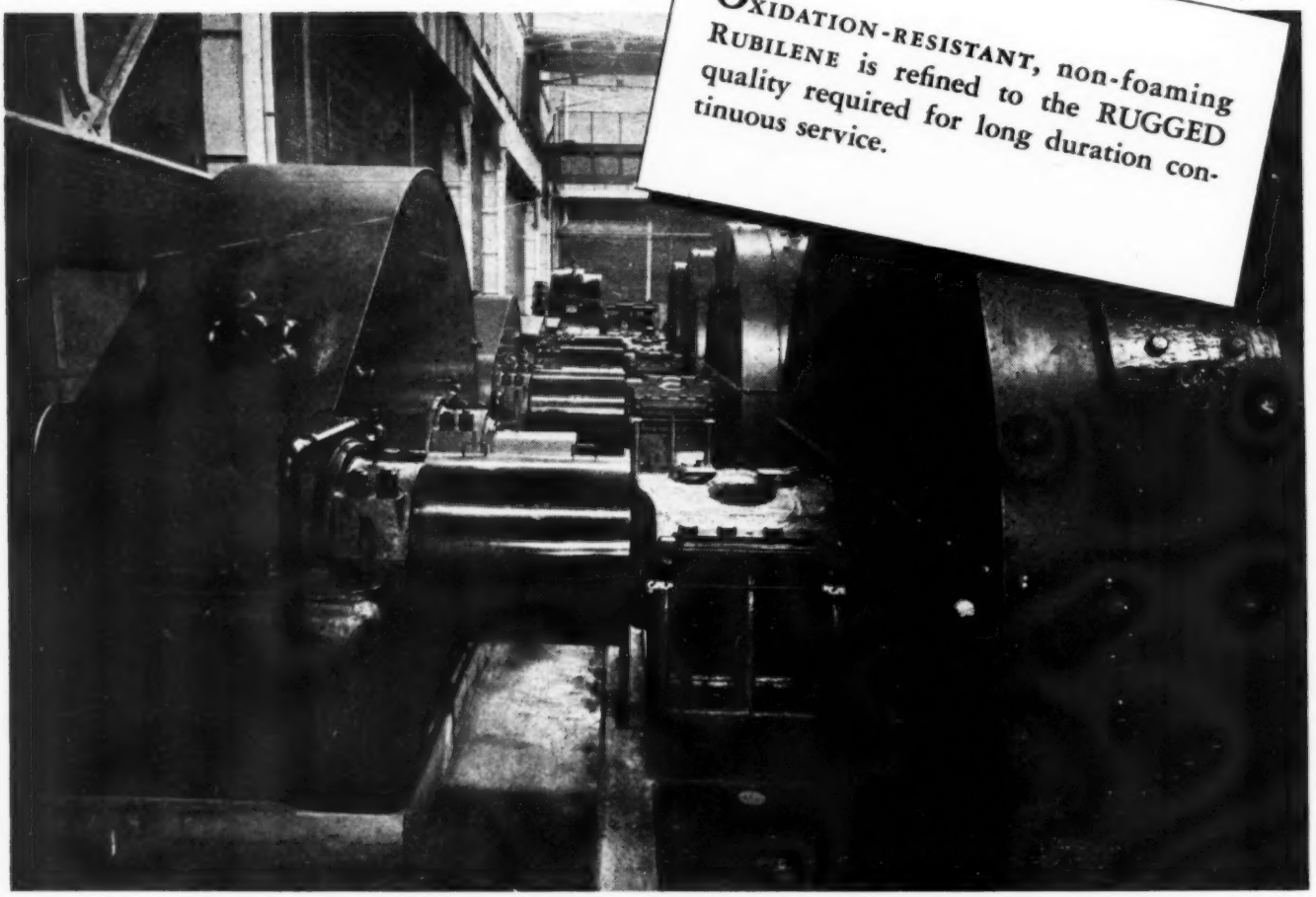
ELGIN SOFTENER CORPORATION

130 NORTH GROVE AVE., ELGIN, ILLINOIS

SOFTENERS ★ FILTERS ★ WATER TREATMENT ★ BOILER WATER CONDITIONING

RUGGED FOR SPEED REDUCERS

SINCLAIR RUBILENE



OXIDATION-RESISTANT, non-foaming RUBILENE is refined to the RUGGED quality required for long duration continuous service.

CONTINUOUS operation of precision-cut gears and bearings in reduction units depends largely on enduring lubrication. The proper lubricant is *rugged* . . . must resist formation of gum and sludge due to oxidation, which is encouraged by whipping and churning of air and oil in the case under high generated temperatures.

RUBILENE meets the challenge of exacting operating requirements. It resists oxidation, gumming and sludging which can prevent proper flow of oil to precision parts and impair lubrication effectiveness at gear teeth. For assured lubrication throughout the entire gear unit . . . choose rugged RUBILENE.

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

is your boiler-water treatment **COMPLETE?**

HERE'S WHAT *COMPLETE* TREATMENT *MUST* INCLUDE

1. Sound Chemical Treatment
(discussed in the February issue)

2. A Good Organic Coagulant
(discussed in the March issue)

3. Simple But Scientific Control

4. Competent Service & Instruction
(to be discussed in the May issue)

SCIENTIFIC CONTROLS ARE NECESSARY TO PREVENT:

- **overtreatment which contributes to carry-over and is wasteful of chemicals**
- **undertreatment which leads to scale and corrosion**
- **excessive blowdown which is wasteful of fuel, chemicals and water**

Proper water testing and control will assure satisfactory conditions—yet, procedures must be so simple that any member of the boiler room crew can easily regulate treatment and blowdown.

BUT—the finest system of control is only ONE of the four requirements for COMPLETE boiler-water treatment.

If you want to know how proper control can help prevent scale, corrosion, carry-over and fuel waste, talk it over with the DREW Man—there's no obligation!

E. F. DREW & CO., INC.
15 East 26th Street, New York 10, N. Y.

COMPLETE AMEROID SERVICE is available in key cities of the United States, Canada, Mexico, Brazil and Porto Rico

AMEROID

THE COMPLETE BOILER-WATER TREATMENT

MAIL THIS COUPON TODAY!

E. F. Drew & Co., Inc.
15 E. 26th St., New York 10, N. Y.
I am interested in further information about COMPLETE Boiler-Water Treatment.

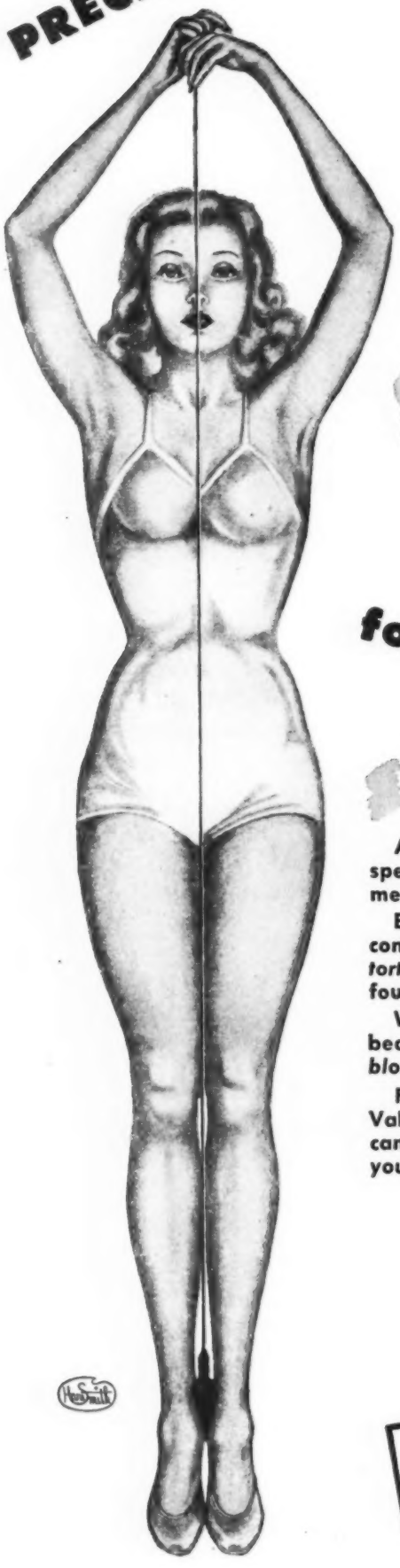
NAME_____

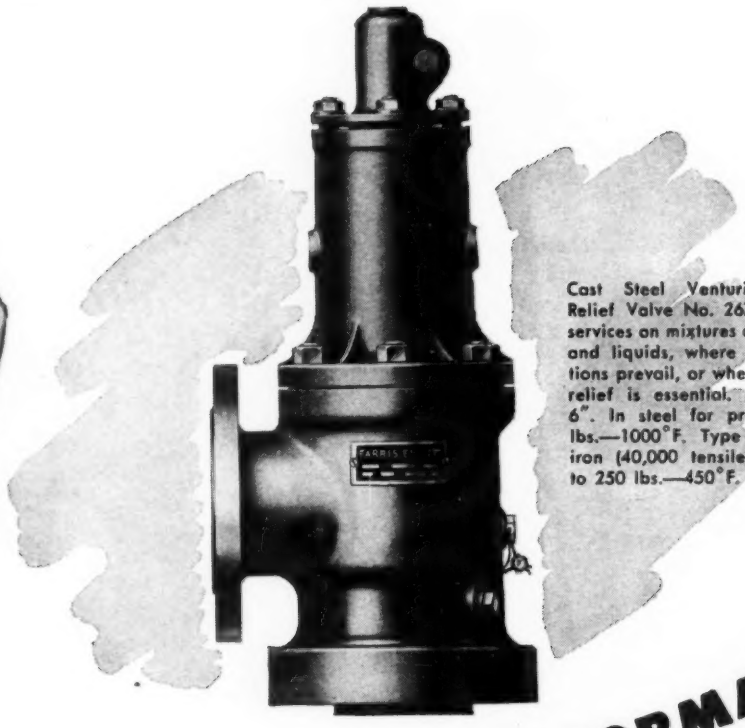
FIRM_____

ADDRESS_____

57

PRECISION ALIGNMENT . . .





Cast Steel Venturi-Type Safety-Relief Valve No. 2675, for difficult services on mixtures of gases, vapors and liquids, where flashing conditions prevail, or when high-capacity relief is essential. Sizes: 1½" to 6". In steel for pressures to 600 lbs.—1000°F. Type 2550, in cast iron (40,000 tensile) for pressures to 250 lbs.—450°F.

for PRECISION PERFORMANCE

A plumb-line, theoretically dropped through a FARRIS Safety or Relief Valve, will always strike the exact center of the spring, disc, stem, guide, seat and all other moving parts . . .

Add to this: the two-bearing guiding (instead of the usual one or three), special gauging, precision tool technique — and you have Precision Alignment . . . for precision performance.

By channelling the full force of the spring directly on the pressure to be controlled, this Precision Alignment *eliminates the dangers of angular distortion.* Troublesome friction is minimized . . . chances of failure from fouling or binding are killed.

We credit our ever-increasing sales of FARRIS Valves to such features because they assure long, safe, trouble-free performance — *with minimum blow-down loss!*

Full information about FARRIS "Precision-Aligned" Safety and Relief Valves is contained in our NEW catalog. For details of how FARRIS Valves can give you precision performance — with priceless protection — *write for your copy today!*

FARRIS ENGINEERING COMPANY
366 Commercial Avenue, Palisades Park, N. J.

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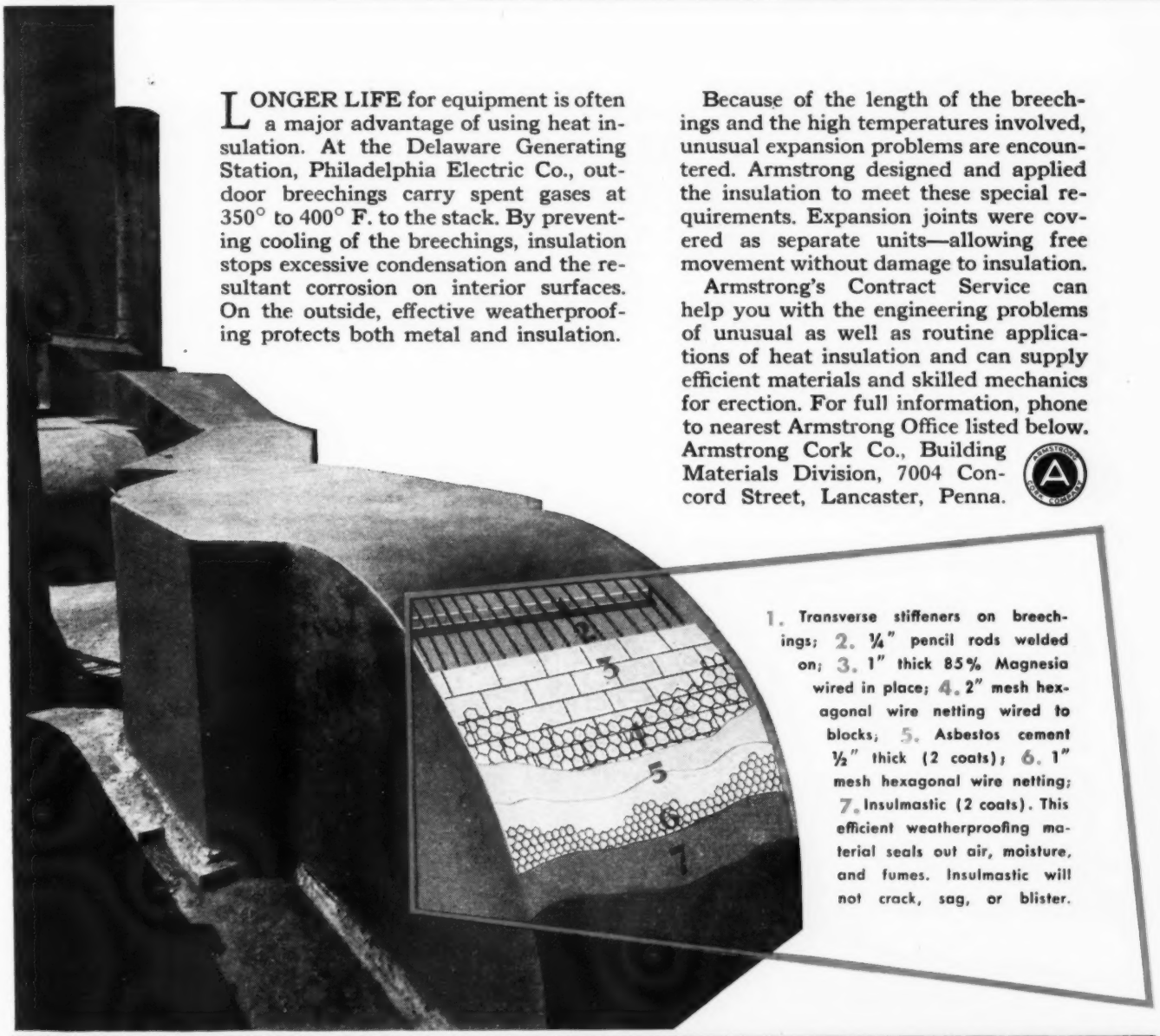
Write today for our new catalog!

Farris
SAFETY and RELIEF VALVES

How to prevent excessive corrosion of metal breechings



LONGER LIFE for equipment is often a major advantage of using heat insulation. At the Delaware Generating Station, Philadelphia Electric Co., outdoor breechings carry spent gases at 350° to 400° F. to the stack. By preventing cooling of the breechings, insulation stops excessive condensation and the resultant corrosion on interior surfaces. On the outside, effective weatherproofing protects both metal and insulation.

Because of the length of the breechings and the high temperatures involved, unusual expansion problems are encountered. Armstrong designed and applied the insulation to meet these special requirements. Expansion joints were covered as separate units—allowing free movement without damage to insulation.

Armstrong's Contract Service can help you with the engineering problems of unusual as well as routine applications of heat insulation and can supply efficient materials and skilled mechanics for erection. For full information, phone to nearest Armstrong Office listed below. Armstrong Cork Co., Building Materials Division, 7004 Concord Street, Lancaster, Penna.

1. Transverse stiffeners on breechings; 2. ¼" pencil rods welded on; 3. 1" thick 85% Magnesia wired in place; 4. 2" mesh hexagonal wire netting wired to blocks; 5. Asbestos cement ½" thick (2 coats); 6. 1" mesh hexagonal wire netting; 7. Insulmastic (2 coats). This efficient weatherproofing material seals out air, moisture, and fumes. Insulmastic will not crack, sag, or blister.

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service
For All Temperatures

From 300° Below Zero

To 2600° Fahrenheit

ALBANY, N. Y. • ATLANTA, GA. • BALTIMORE, MD. • BIRMINGHAM, ALA. • BOSTON, MASS. • CINCINNATI, OHIO • CLEVELAND, OHIO
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KANSAS CITY, MO. • LOUISVILLE, KY. • MEMPHIS, TENN. • MILWAUKEE, WIS. • NEW ORLEANS, LA. • NEW YORK, N. Y. • PHILADELPHIA, PENNA.
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PEVELY

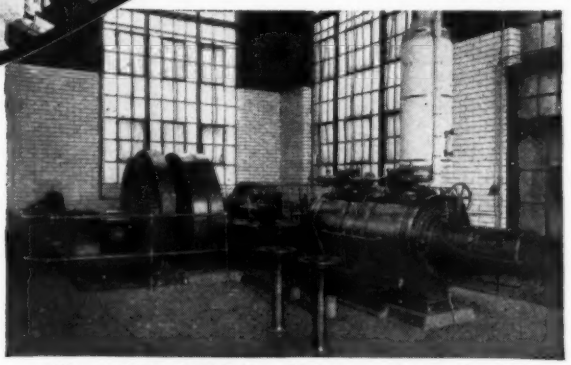
THE PIONEER MODEL DAIRY IN ST. LOUIS

5 SKINNER "UNIVERSAL UNAFLOW" STEAM ENGINES

DRIVE GENERATORS AND COMPRESSORS

THE famous Pevely Dairy was founded by Martin W. Kerckhoff way back in 1887, when most St. Louis residents still kept a cow in the back yard. In 1899 Mr. Kerckhoff pioneered the use of glass bottles, and planned his own bottling machine. He lived to see the ground broken for the first buildings of the present great plant, in 1916. Five grandsons still maintain the family tradition of progressive innovation and expansion.

It has always been a pleasure to us to do business with the Pevely Dairy people, and our association extends over a good many years. Two Skinner "Universal Unaflow" Steam Engines generate electric power, one driving a 300-kw. generator, and the other a 150-kw. generator. Two 200-hp. engines and a 590-hp. engine are used to drive ammonia compressors.



The original 300-kw. "Universal Unaflow" engine-generator unit in the Pevely plant

The Pevely Dairy is one of more than 2000 establishments which are relying on Skinner "Universal Unaflow" Steam Engines for dependable and economical power. The list includes other dairies, and a variety of processing and manufacturing plants, department stores, office buildings, hotels, schools and institutions, that give conclusive evidence of the versatile adaptability of "Universal Unaflow" Engines. Without involving you in any expense or obligation, our engineers will give you complete data and figures on an installation to care for your needs.

BUY * VICTORY * BONDS

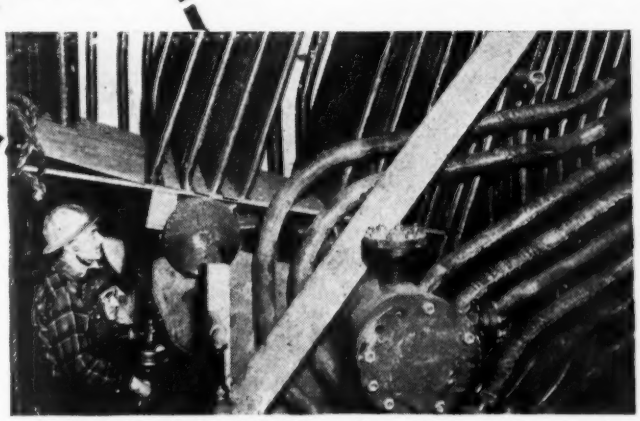
For Over 76 Years, Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

dual service...with a single purpose

Piercing Seamless Tubing in one of the B&W specialty tube mills.

B&W Welded Tubing is made by the Electric-Resistance welding process.



Finding the right kind of tubing for any steam generating and heat transfer equipment is greatly simplified when the problem is put up to Babcock & Wilcox. Matching tubes to jobs—applying the kind that will stand up best in any combination of operating conditions—is a specialty at B&W.

Here your requirements are considered in the light of over 40 years' experience gained from making more than 700 million lineal feet of pressure tubing—both seamless and welded—for all types of stationary, locomotive and marine boilers as well as for heat exchangers, condensers and other power plant applications. The time-saving, cost-cutting advantages of using B&W tubes are being secured in equipment operating at pressures up to 4500 lb. and temperatures as high as 1500 F. Because of its dual tube-producing facilities, B&W matches tubes to your equipment without prejudice toward any type or materials. You can therefore depend on B&W recommendations being both authoritative and unbiased, and aimed at this single objective: supplying you with the best tubing for each specified job.

Water-Tube Boilers, for Stationary Power Plants, for Marine Service . . . Water-Cooled Furnaces . . . Superheaters . . . Economizers . . Air Heaters . . . Pulverized-Coal Equipment . . . Chain-Grate Stokers . . . Oil, Gas and Multifuel Burners . . . Seamless and Welded Tubes and Pipe . . . Refractories . . . Process Equipment.

BABCOCK & WILCOX SEAMLESS & WELDED TUBES

THE BABCOCK & WILCOX TUBE COMPANY
WELDED TUBE DIVISION • ALLIANCE, OHIO
SEAMLESS TUBE DIVISION • BEAVER FALLS, PA

PERMANENTLY INSULATED TO RESIST HEAT FUMES - OIL - GREASE - MOISTURE - FLAME

From the three basic designs illustrated Rockbestos has developed a complete line of 125 failure resisting wires, cables and cords, a few of which are described. All have the same performance guaranteeing characteristics detailed below. Write for catalog or samples.

Rockbestos Permanent Insulation Insures Long-Lived Service

1. A tough impregnated asbestos braid, resistant to heat, flame, moisture, oil, grease, alkalies and corrosive fumes.
2. Felted asbestos insulation impregnated with heat, flame and moisture resisting compounds will not dry out with age, burn, or bake brittle under high temperatures.
3. Lubricated varnished cambric for high dielectric strength and added moisture resistance — protected from heat, flame and oxidation by felted asbestos walls.
4. Impregnated asbestos insulation that withstands heat of overloads and aging and won't become brittle, crack, rot or burn.
5. Conductors are perfectly centered in helically applied non-flowing insulation and will always remain so.

ROCKBESTOS A.V.C. 600 VOLT SWITCHBOARD WIRE
(National Electrical Code, Type AVB)

Sizes No. 18 to No. 4/0 AWG with varnished cambric and impregnated asbestos insulation and gray, black, white or colored flameproof braid.

Combine fire insurance and fine appearance in your switchboards with Rockbestos Switchboard Wire. It is fireproof and will not dry out under heat. Sharp, clean bends can be made without cracking as the asbestos wall acts as a cushion under the braid. Rockbestos A.V.C. Hinge Cable and Switchboard Bus Cable have the same characteristics.

ROCKBESTOS A.V.C. 600 VOLT MOTOR LEAD CABLE
(National Electrical Code, Type AVA)

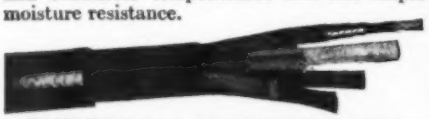
Size No. 18 AWG to 1,000,000 CM insulated with two walls of impregnated asbestos and a high-dielectric varnished cambric insert, with a heavy asbestos braid overall.

Use this apparatus cable for coil connections, motor and transformer leads exposed to overloads or high ambient temperatures. It makes a permanent installation as it is resistant to heat, flame, oil, grease and moisture.

ROCKBESTOS A.V.C. 600 VOLT POWER CABLE
(National Electrical Code, Type AVA)

Sizes No. 18 AWG to 1,000,000 CM insulated with laminated felted asbestos, varnished cambric, and asbestos braid. Other constructions for service voltages to 5000.

This cable is recommended for power leads of heat-exposed equipment and circuits that run near boilers, steam lines, furnaces, kilns and other hot spots. It withstands high ambient and conductor temperatures and has ample moisture resistance.



ROCKBESTOS A.V.C. 600 VOLT CONTROL CABLE

In one to 19 conductors with individuals insulated like Motor Lead Cable, cotton braid covered and cabled with an asbestos braid over all. Standard strandings AWG No. 12—19/#25 and No. 9—19/#22. Other strandings on order.

Designed for applications requiring a multi-conductor control cable capable of withstanding high temperatures, corrosive fumes, oil, grease and moisture. It also eliminates fire hazard as it will not burn. Used by equipment manufacturers, power companies, steel mills.

ROCKBESTOS A.V.C. 600 VOLT BOILER ROOM WIRE
(National Electrical Code, Type AVA)

Sizes No. 18 to 8 AWG insulated with varnished cambric, impregnated felted asbestos and asbestos braid. Sizes 6 to 4/0 have another wall of felted asbestos next to the conductor.

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard, such as exist around furnaces, ovens, lehrs, soaking pits, boilers, etc., this widely used wire is ideal. Its permanent insulation won't bake brittle, crack, rot, flow or swell.

ROCKBESTOS THERMOSTAT CONTROL WIRE

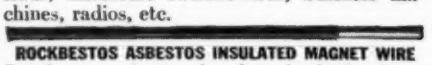
Sizes No. 14, 16 and 18 AWG in two to six conductors with .0125", or .025" or (for 115 volt service) .031" of impregnated felted asbestos insulation and steel armor.

A multi-conductor control wire for low voltage inter-communicating, signal, and temperature control systems. Heatproof, fireproof insulation and rugged steel armor give troubleproof circuits.

ROCKBESTOS 300 VOLT HEAT RESISTING FIXTURE WIRE
(Underwriters' Type AF)

Sizes No. 10 to 18 AWG stranded plain copper conductor insulated with black or white impregnated felted asbestos—with or without braid.

Rockbestos asbestos insulated fixture wires, approved by the Underwriters' Laboratories, are ideal for lighting fixture wiring because their heat resistant insulation will not bake out under the high socket temperatures developed in modern fixtures. Also used for small motor leads, miniature switchboards, business machines, radios, etc.



ROCKBESTOS ASBESTOS INSULATED MAGNET WIRE

Round, square and rectangular asbestos insulated conductors finished to meet varying winding conditions and coil treatment requirements.

Protect motors against heat-induced breakdowns with class B windings of this heat resisting magnet wire. Leads of Rockbestos A.V.C. Motor Lead Cable will complete the failure-proofing.

ROCKBESTOS A.V.C. 600 VOLT FLEXIBLE CORD

Sizes No. 10 to 18 AWG with two or three conductors insulated with impregnated felted asbestos, varnished cambric, felted asbestos, covered with heavy impregnated asbestos braid.

A heavy duty, high-dielectric, heat and moisture resistant flexible cord used in locomotive cab circuits, high wattage lighting units, floodlights and for leads on apparatus exposed to heat. Specify polarized conductors if desired. For high temperature applications where resistance to moisture is not required specify All-Asbestos insulated constructions.

ROCKBESTOS 300 VOLT HEAT RESISTING DUPLEX FLEXIBLE CORD
(Underwriters' Type AFPD)

Sizes No. 10 to 18 AWG stranded plain copper conductors insulated with impregnated felted asbestos, polarized, twisted together and covered with a cotton braid.

This heat-resisting cord is approved for use in lighting fixtures and is recommended for pendant types as it does not dry out or crack at the socket. Also on apparatus and appliances which develop heat in operation or are used in hot, dry places. Twisted pair, tripled or triplex constructions also available.

ROCKBESTOS ALL-ASBESTOS 600 VOLT RHEOSTAT CABLE
(National Electrical Code, Type AI)

Sizes No. 18 AWG to 1,000,000 CM insulated with a heavy wall of felted asbestos, covered with a rugged asbestos braid finished in black, white or colors.

Use this cable for wiring rheostats, switchboards, elevator and locomotive control panels and equipment exposed to heat, fumes or fire hazard — also for open power circuits in hot, dry locations. For flexible conductor specify Rockbestos All-Asbestos Flexible Apparatus Cable — for solid conductor, Rockbestos All-Asbestos Rheostat Wire.

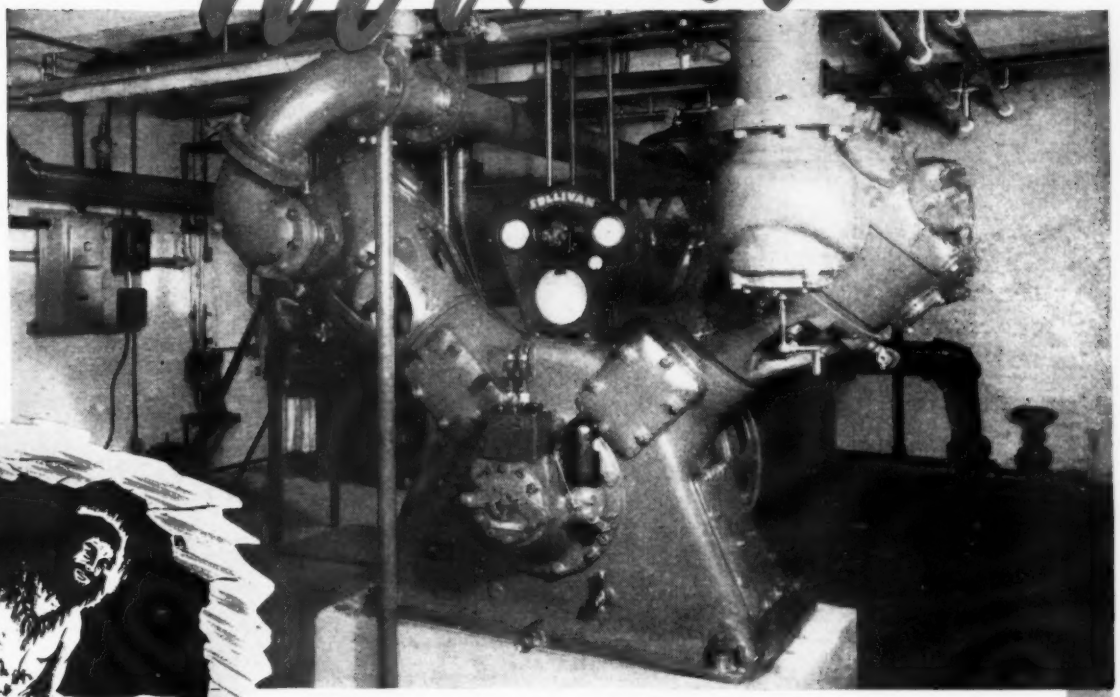
ROCKBESTOS PRODUCTS CORP., 130 Nicoll St., New Haven 4, Conn.

125 STANDARD TYPES

ROCKBESTOS

The Wire with Permanent Insulation

Maintenance Engineers call them *hermits!*



Sullivan WN-112 air compressors

Maintenance engineers call their Sullivan WN-112 air compressors "hermits" because they turn out full rated capacity twenty-four hours per day year after year with so little attention that they are almost forgotten. It is not unusual for them to run thousands of hours continuously without any maintenance.

Sullivan WN-112 compressors are modern, two-stage, double-acting, heavy-duty, continuous-service compressors, much smaller than old style compressors of the same capacity and yet have operating economies exceeding those of the older, bulky units.

Available in single or twin units with piston displacement capacities ranging from 378 c.f.m. to 1828 c.f.m. at pressures up to 125 p.s.i. For complete details ask your nearest Sullivan office for Bulletin A-52. **Sullivan Machinery Company, Michigan City, Indiana. In Canada: Canadian Sullivan Machinery Co., Ltd., Dundas, Ont.**

SULLIVAN

THE WORLD'S FINEST AIR COMPRESSORS from 1/4 to 3,000 H. P.

PRODUCTS:
STATIONARY AND PORTABLE AIR COMPRESSORS
PNEUMATIC CASTING GRIPS - FOUNDATION
BREAKERS - PORTABLE HOISTS - ROCK DRILLS

Offices: SEATTLE - BOSTON - NEW YORK - CHICAGO - PORTLAND - PITTSBURGH - ST. LOUIS
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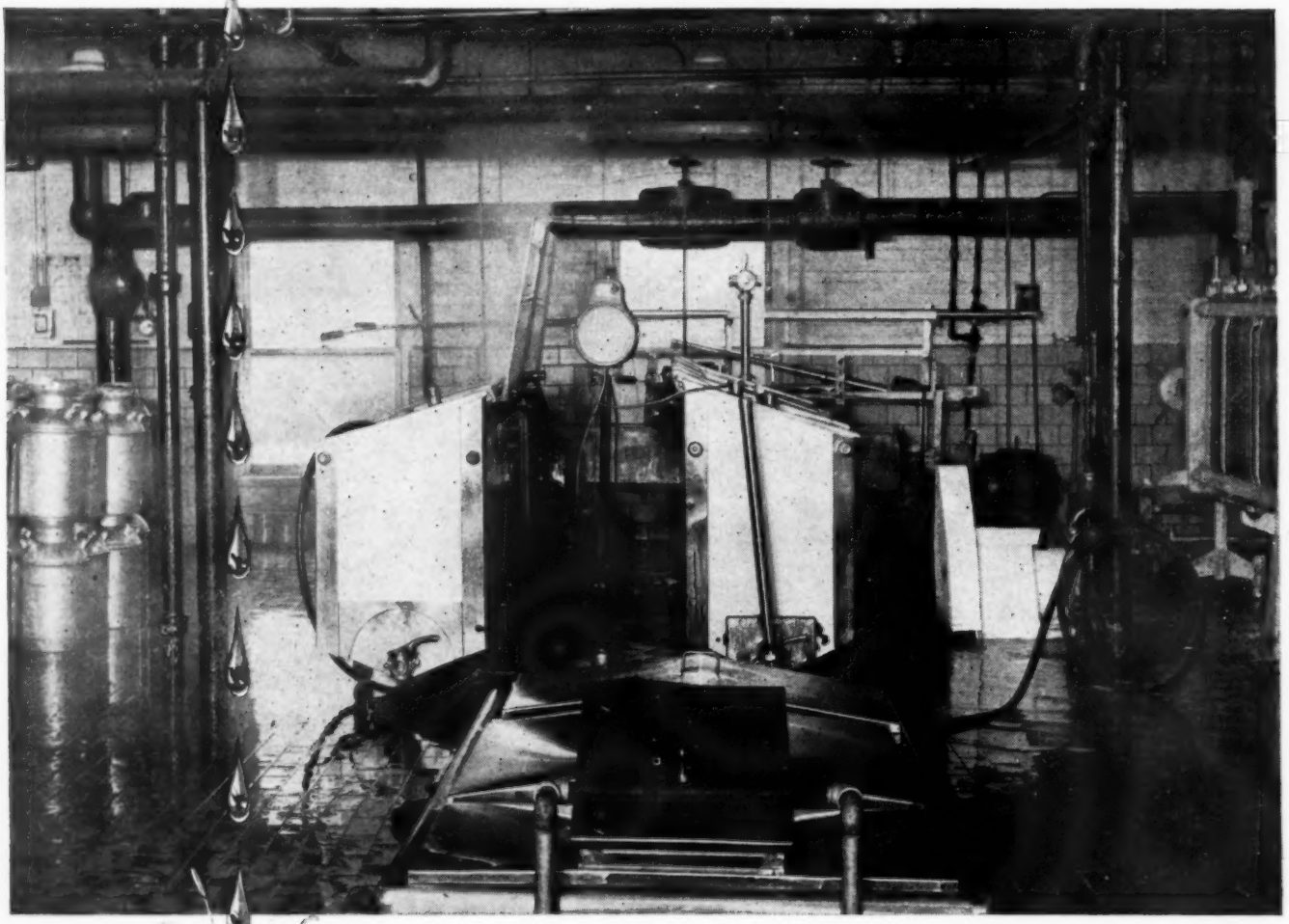
HOW FIBERGLAS INSULATION



BEATS THE MOISTURE PROBLEM

Moisture is a major cause of trouble in many plants—especially where steam turns to liquid "in the wrong places", where condensation forms drops and puddles, where operating conditions create high humidity.

To avoid the costly damage caused by uncontrolled moisture to pipe, boiler and other exposed insulation, many concerns are standardizing on Fiberglas. In addition to its higher thermal efficiency it has exceptional resistance to the effects of moisture.

Fiberglas is glass in the form of fine fibers. The individual fibers do not absorb moisture. Therefore, should the insulation become wet due to adverse operating circumstances, it will dry out rapidly when surrounding conditions permit. Moisture does not cause Fiberglas to rot or disintegrate. When dried again, its insulation value is fully restored.

This better insulation material is produced in a form to meet virtually every interior and exterior insulation need—for pipes, boilers, ducts, ovens, tanks and other equipment. And Fiberglas Industrial Insulations are easily and quickly applied by standard methods for both high and low-temperature requirements.

Be sure that you have complete information. Write for the booklet "Fiberglas Insulations for Industry". Owens-Corning Fiberglas Corporation, Dept. 2000, Toledo 1, Ohio. Branches in principal cities.

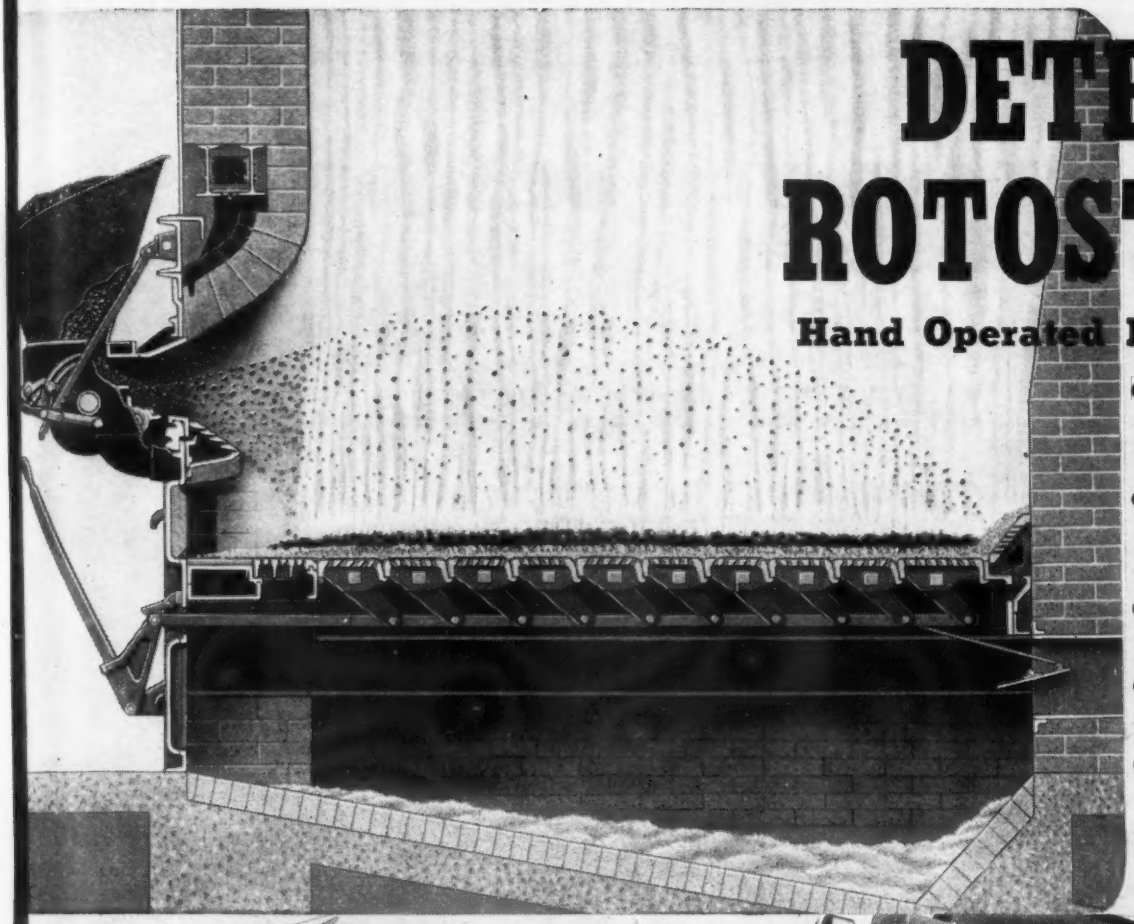
In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.

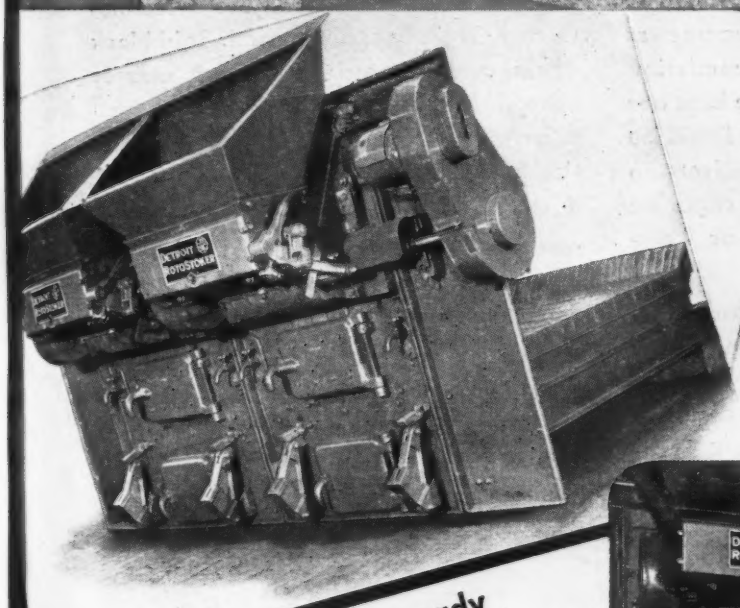
OWENS-CORNING FIBERGLAS

DETROIT ROTOSTOKER

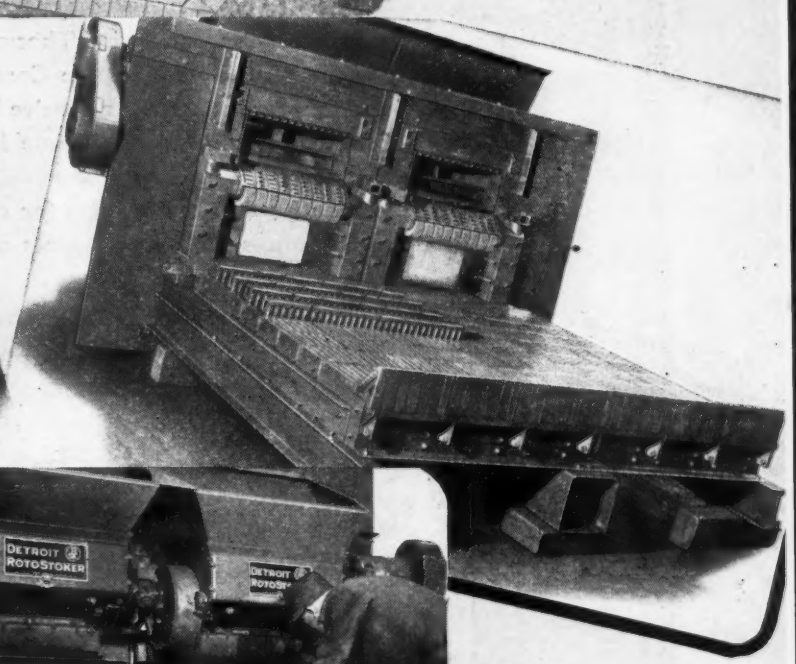
Hand Operated Dumping Grates

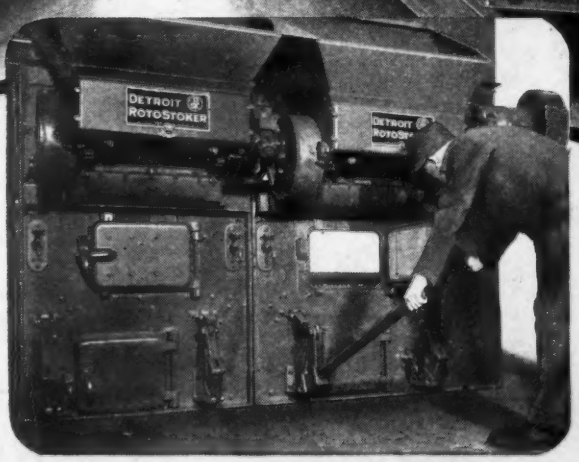
- OVERTHROW ROTORS FOR UNIFORM FUEL DISTRIBUTION
- FUEL AND AIR CONTROLLED—OPERATES WITH HIGH CO_2
- BURNS WIDE RANGE OF FUELS
- HANDLES FLUCTUATING LOADS
- COMPACT—SIMPLE DESIGN
- EASY TO OPERATE





Detroit RotoStoker ready for inspection and shipment.





Stoker grates cleaned by releasing dumping levers at front

DETROIT STOKER COMPANY

Fifth Floor, General Motors Building, Detroit, Michigan • Works at Monroe, Michigan

District Offices in Principal Cities • Built in Canada at London, Ontario

HAVE YOU HEARD?

TAYLOR IS SHIPPING 5-INCH INDUSTRIAL THERMOMETERS FROM STOCK!

IT'S TRUE! During the war we made thousands of these compact, accurate 5-inch Taylor Industrial Thermometers for the Navy and Maritime Commission and for war industry. And we've kept our production rolling at wartime levels so that you can now have prompt delivery on all you need. They're ideal for checking temperatures in limited spaces or wherever vibration is a problem.

Why not check your needs and order today? These sturdy 5-inch thermometers are built to Taylor quality specifications and are particularly adapted to such installations as DIESEL ENGINES, AIR COMPRESSORS, LUBRICATING OIL LINES, GENERATORS, REDUCTION GEARS, AND SMALL DIAMETER BRINE, WATER AND STEAM LINES.

Triple lens "Binoc" tubing (pronounced Buy-Noc) makes these Taylor thermometers three times easier to read. Bold black figures and graduations contrast sharply against the white scale. New, rugged one-piece case is completely rattleproof, practically dustproof.

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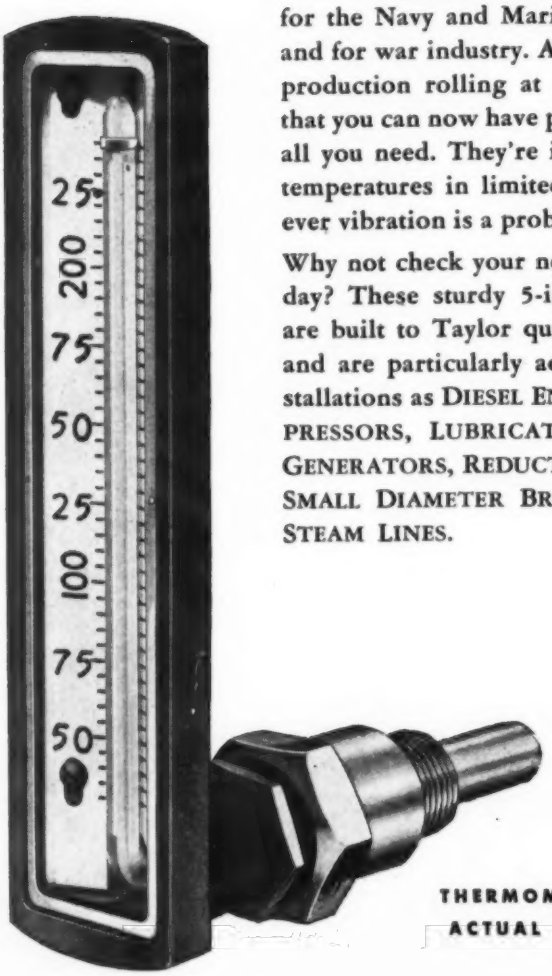
Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.



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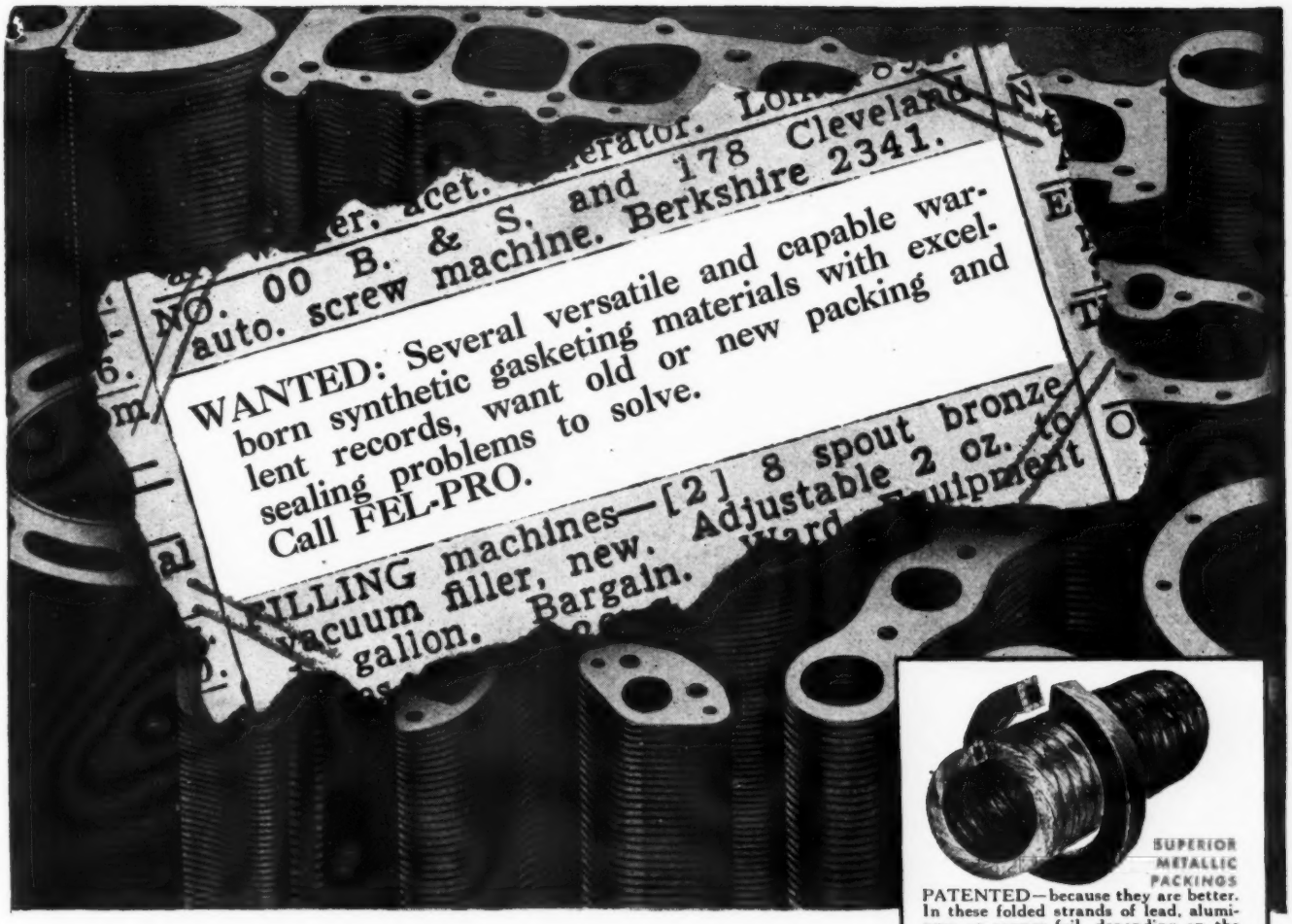
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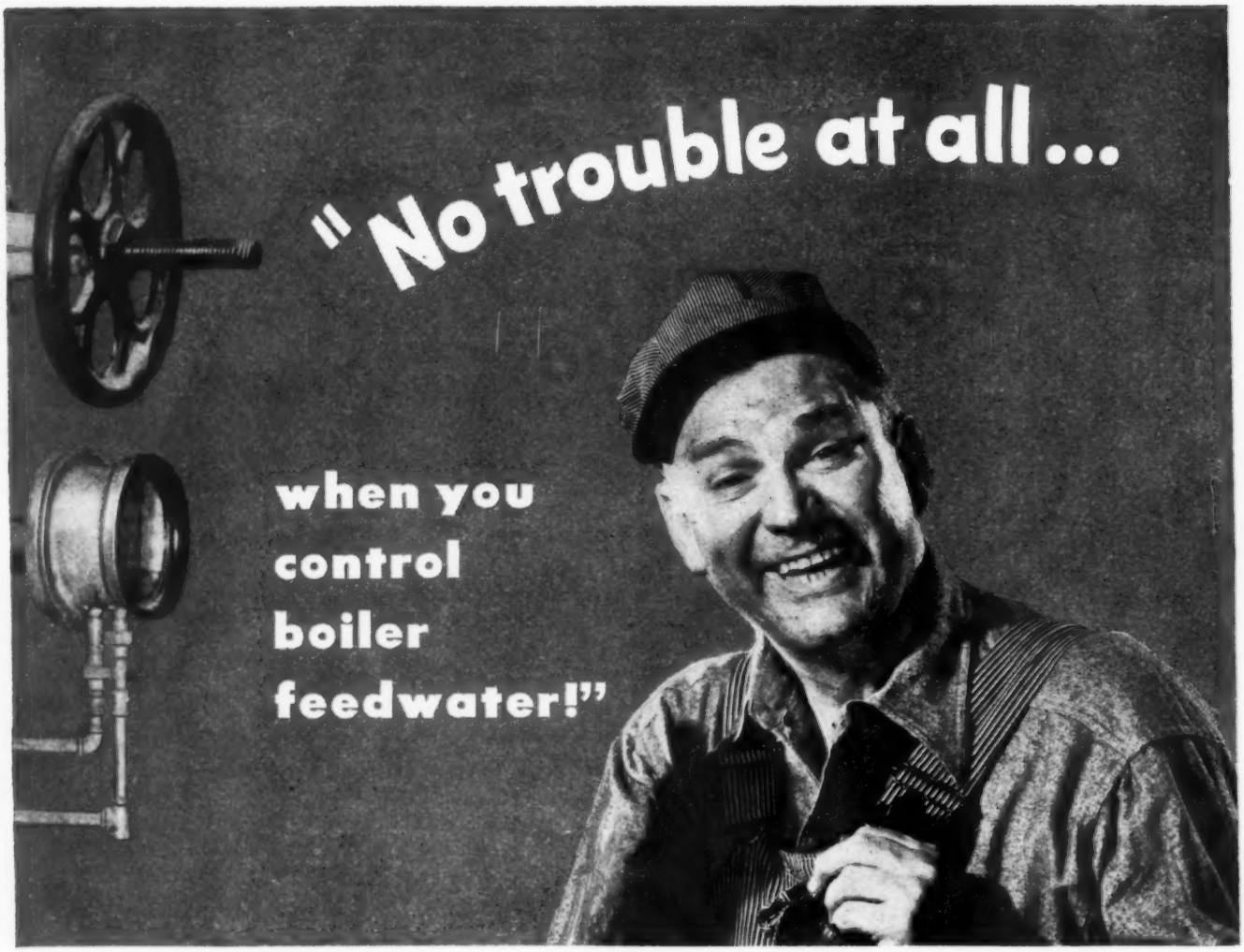

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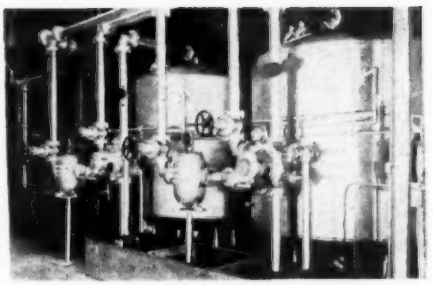

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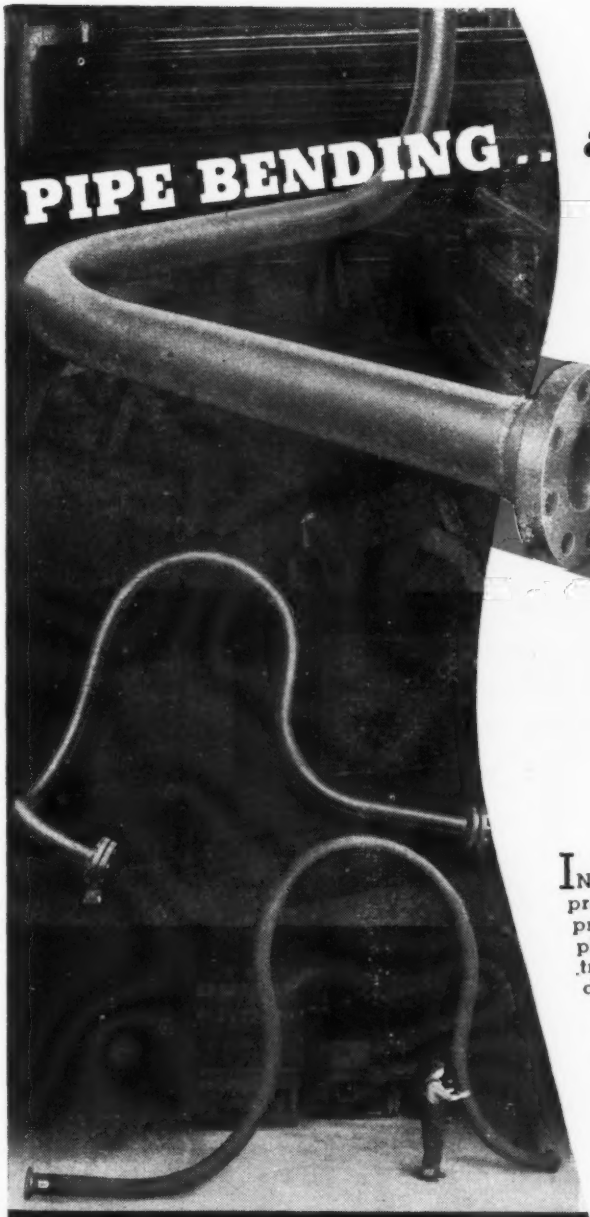

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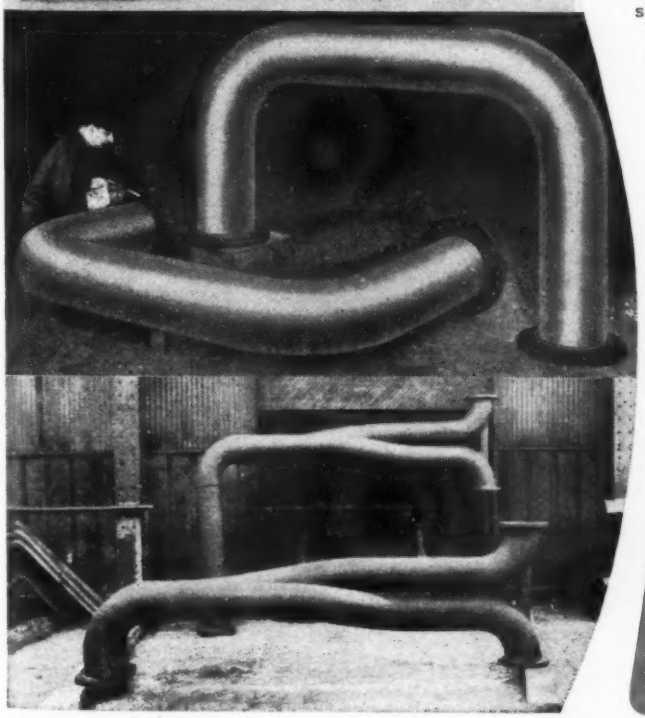
MODERN SHOP FABRICATION

IN modern streamlined piping systems the utilization of pipe bends provides many advantages not obtainable through the use of fittings . . . provided the bends are properly designed and shop-fabricated in a plant that has the necessary facilities and equipment, and a crew of trained experts who know how to use that equipment, in this highly developed art of piping fabrication.

Pipe bends may be made for any desired overall length; a number of bends may be made in a single length of pipe, so as to produce a pipe connection, tailor-made for available space; flexibility is provided in systems subject to thermal expansion; long-radius bends often save material and reduce pressure drop caused by internal pipe friction.

Expert shop fabrication provides proper distribution of field welds and confines them to areas not subject to high bending stress; it reduces the number of welds and saves time, in both shop and field.

When planning and designing piping systems for additions, alterations or new installations, consider the advantages of incorporating pre-fabricated pipe bends in place of fittings. They are tailored to fit installation conditions, without interference with other piping or auxiliary equipment. The result is a neater, more compact and efficient system, and field installation time is reduced to a minimum.



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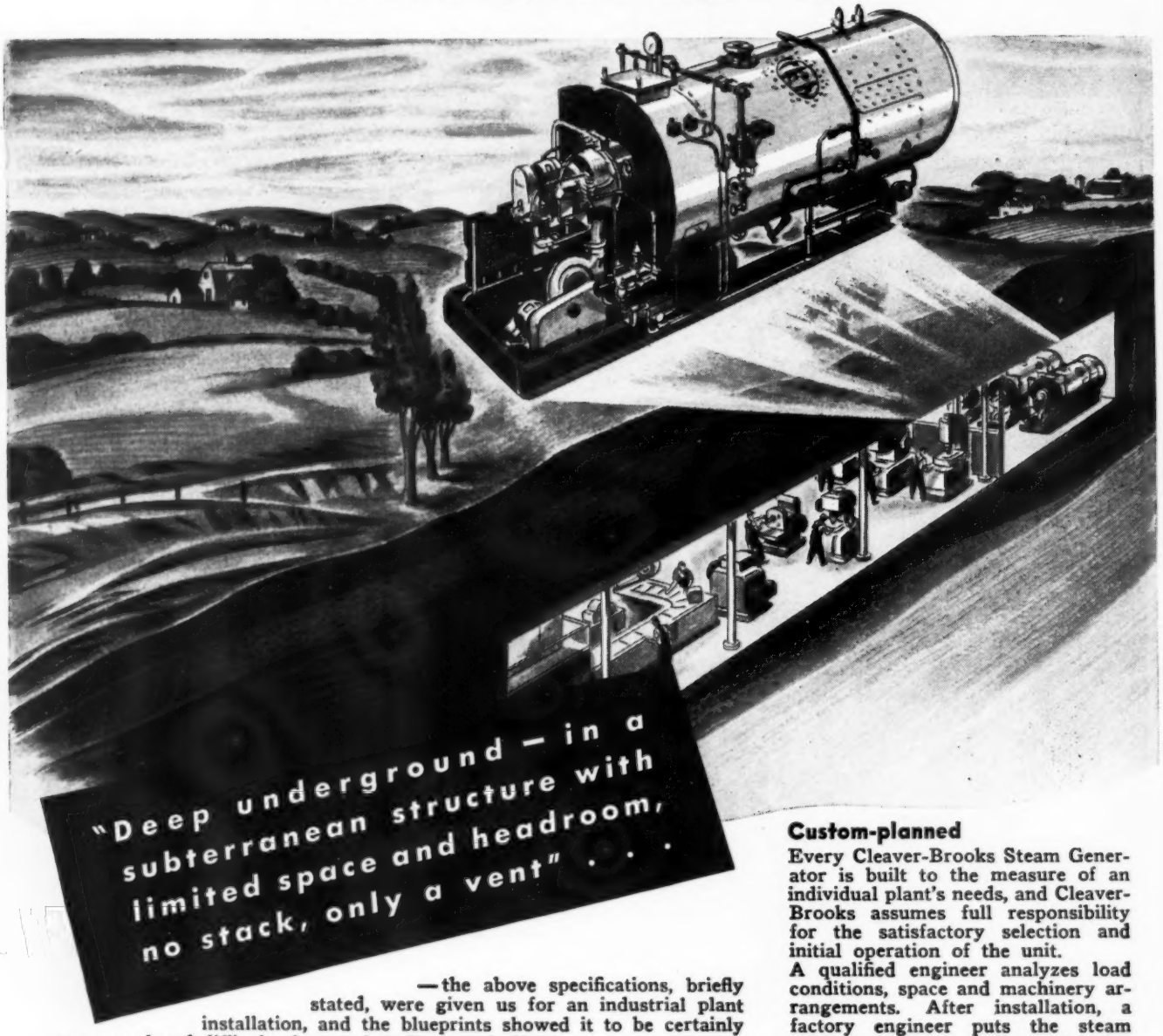

—the above specifications, briefly stated, were given us for an industrial plant installation, and the blueprints showed it to be certainly an unusual and difficult place to install steam boilers.

But it was a "natural" for Cleaver-Brooks Steam Generators. Read this factual report: "The boiler plant consists of seven Cleaver-Brooks oil-fired steam generators. They supply steam to heat exchangers which generate hot water for heating, air-conditioning, and process use. Built and shipped as 'packaged units,' no erection was required except moving them into place and connecting piping and wiring."

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If you have special problems in steam or heat generation and utilization, Cleaver-Brooks engineers can help to solve them.

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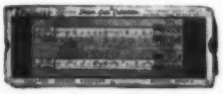

WRITE on your business letterhead for the Free Steam Cost-Calculator —a ready-reference slide rule showing the comparative steam costs when using oil or coal as fuel.

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STEAM
GENERATORS

Custom-planned

Every Cleaver-Brooks Steam Generator is built to the measure of an individual plant's needs, and Cleaver-Brooks assumes full responsibility for the satisfactory selection and initial operation of the unit.
A qualified engineer analyzes load conditions, space and machinery arrangements. After installation, a factory engineer puts the steam generator into operation and trains plant employees on its operation, care and maintenance.

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Delivery consists of a "packaged" unit. Connections to service outlets are all that is needed. No smokestack is used—a simple vent carries away all products of combustion. No extra foundation is required. Compact—the unit fits into limited space and low head-room locations. Sizes: 22 models—15 to 500 hp.; pressures 15 to 200 lbs. p.s.i.

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The Cleaver-Brooks Steam Generator is designed for easy operation and low upkeep cost. Operation is at 80% efficiency from full load down to 30% of its rating. The high heat transfer from the 4-pass, down-draft boiler produces fast steaming. A "kitchen-clean" boiler room is possible through the use of oil for fuel.

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BOILERS

TEMPERATURE _____ PRESSURE _____

SETTINGS _____ BOILER WALLS _____

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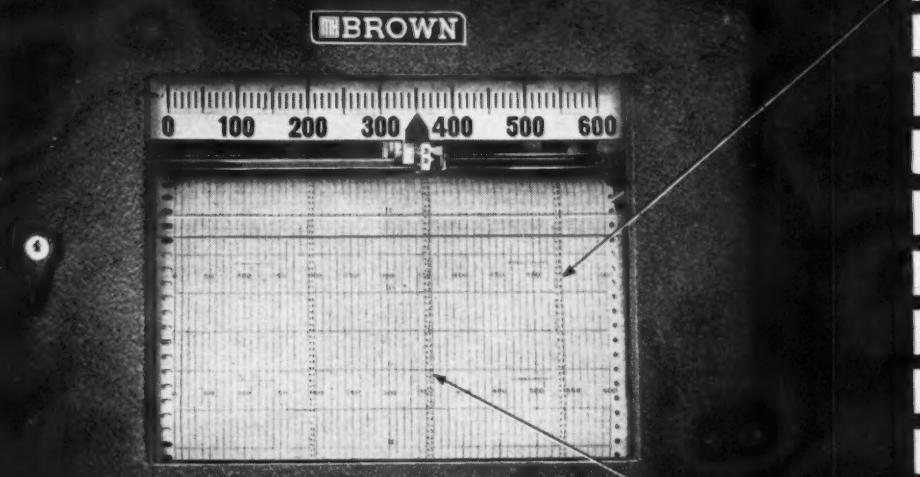

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ALL RELATED TEMPERATURES RECORDED ON ONE CHART

The Brown *ElectroniK* Multi-record Potentiometer provides chart records of all power plant temperatures, some of which are shown above.

An invaluable aid to power plant engineers for operating efficiently and allocating costs properly, the Multi-record *ElectroniK* will record from 2 to 16 unicolor records or from 2 to 12 multi-colored records on a single chart. A commutator switch connects the circuits in sequence. Records are produced by means of a print wheel, the operation of which is similar to that of a printing press. Each record consists of a series of numbers and a plus sign, the latter representing the exact temperature and time coordinate.

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BROWN *Electronik* POTENTIOMETERS

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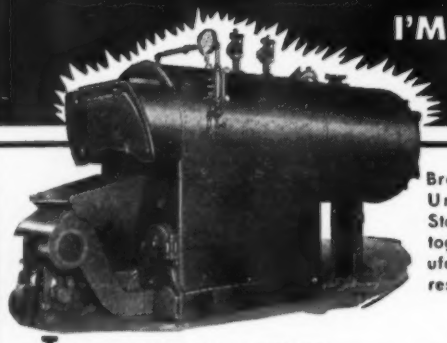

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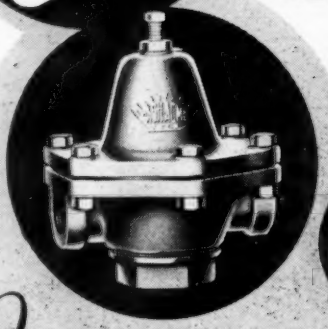

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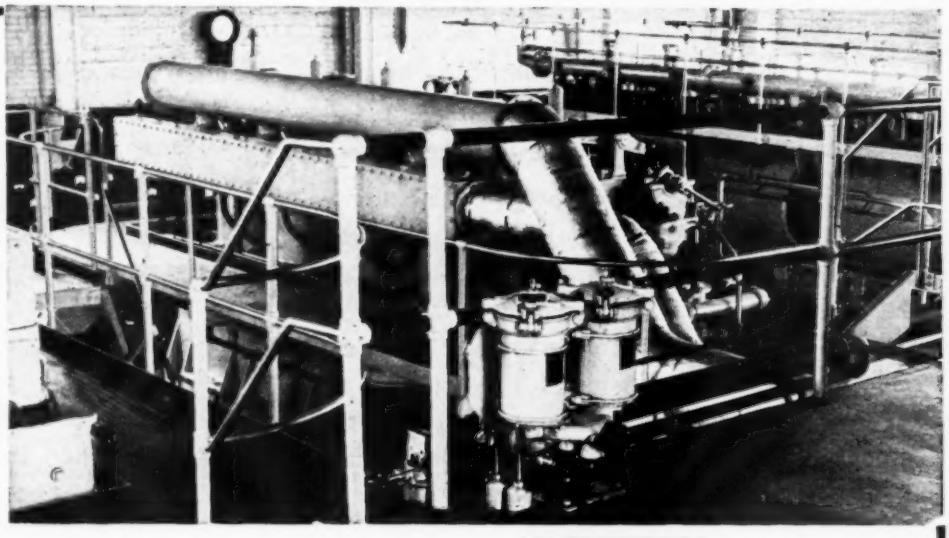

This time, Nugent Filters are at work in the Municipal Electric Plant at Maquoketa, Iowa, protecting the 1200 horsepower McIntosh & Seymour Diesel engine shown above against "down time" due to dirty fuel oil. This is one of four diesel units installed here, all of which are equipped with Nugent large-area filters. The Duplex Filter illustrated is installed between the day tank and the engine to assure positive protection.

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MARLEY NOZZLES

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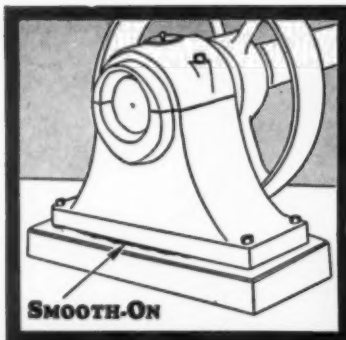

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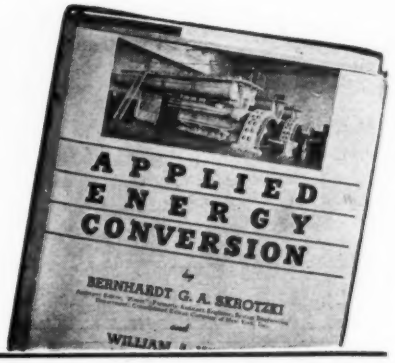

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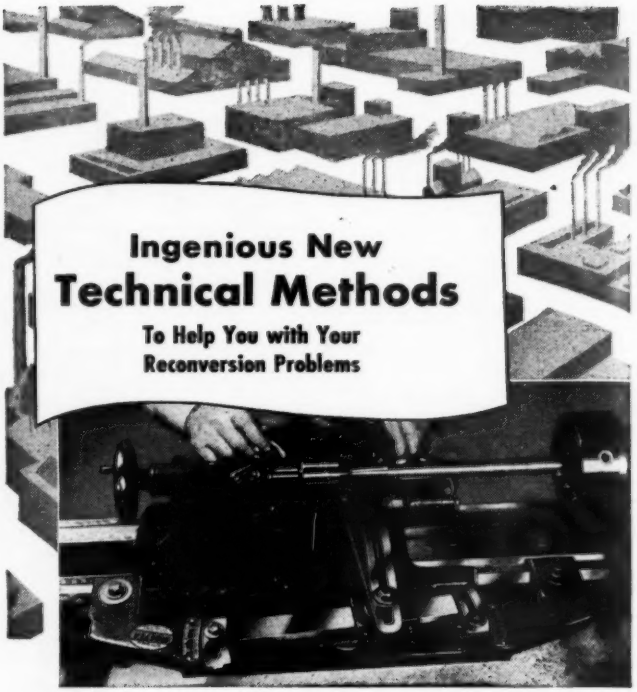
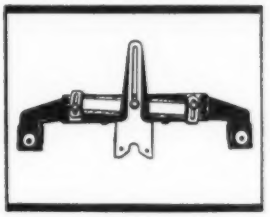


Simplified Master Taper Attachment Fits All Types of Lathes Instantly!

Now! A "universal" taper attachment that fits all lathes, old or new, big or small—that can be attached or removed in *minutes!* This taper attachment is not bulky or cumbersome. It bolts easily to the bed, in the back of any lathe.

The Master performs accurate taper turning, boring and threading with the ease of any straight line tool operation. It precisely duplicates any tapered part. Is usable in any position. Does not interfere with straight turning. The bar is precisely machined and fitted. There is no vibration. Taper graduations are in inches at one end; degrees at the other. The master is available now, in two sizes; two feet and four feet in length.



Model 710
Master Taper Attachment

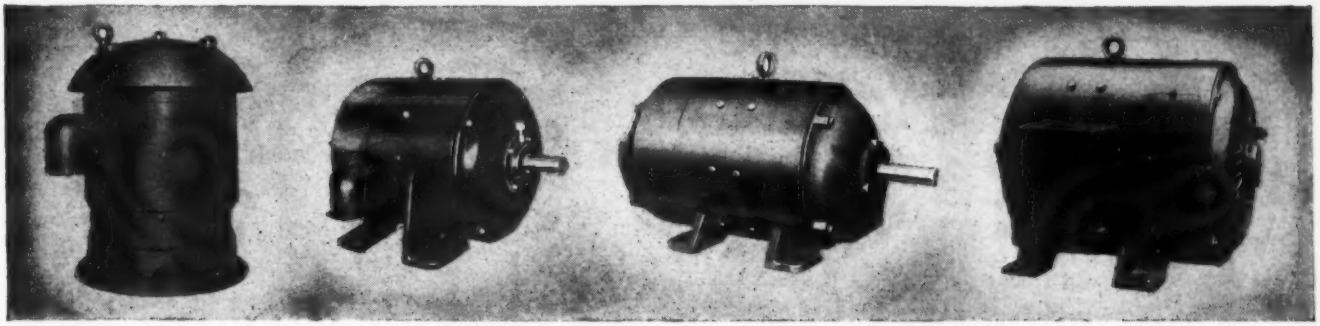
Available today also, is delicious Wrigley's Spearmint Gum. This is one treat you can enjoy even when your hands are busy. And the pleasant chewing helps to keep you alert and wide-awake, even through a monotonous job.

Chewing Wrigley's Spearmint satisfies a fellow. In addition, it helps keep your mouth moist and fresh—so you feel better. And feeling better, you naturally work better. By making gum available to all, scores of plants and factories report increased morale and efficiency that really pays off.

You can get complete information from the Keene Electrical Machinery Co., 549 W. Washington Blvd., Chicago 6, Ill.

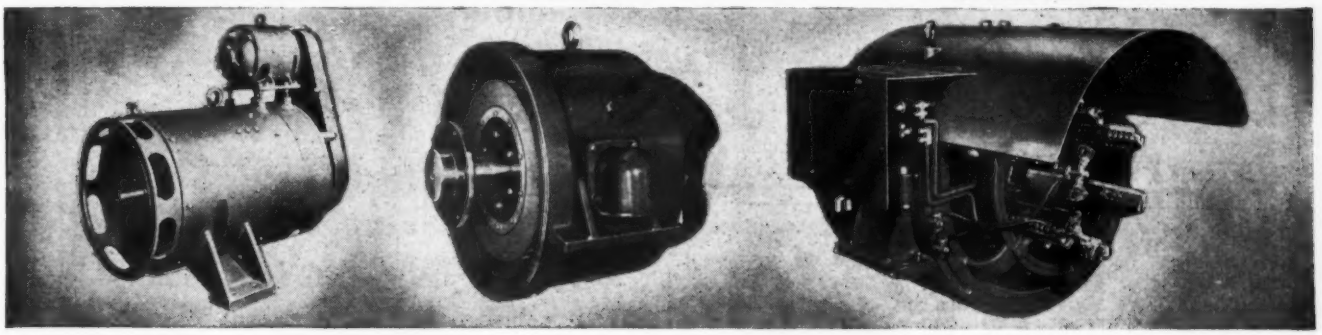
AA-64

THERE'S ONE CORRECT
DC MOTOR OR GENERATOR
that best fits into your plant or product



25 HP. Vertical D.C. Motor | 30 HP. Drip-proof D.C. Motor | 15 HP. Splash-proof D.C. Motor | 75 HP. Drip-proof D.C. Motor

75 k.w. D.C. Generator with 5 k.w. Auxiliary | 30 k.w. D.C. Generator with Side Feet | 250 k.w. D.C. Generator Drip-proof Engine Type



BURKE, one of the oldest of D.C. equipment manufacturers specializes in D.C. motors from 1 to 1500 HP and generators to 1000 KW. Motor speeds vary from 100 to 1800 RPM either constant, varying or adjustable. Drives may be coupled, belted or engine type. Generators may be single, 2-bearing or engine type. In selecting the correct D.C. unit for your need, make use of Burke's wide experience. Burke designs for the job not to the rigid and limiting standards of stock designs.

For a description of the complete Burke line of AC and DC motors and generators, consult Sweet's Engineering catalogs or Electrical Buyers Reference catalog.

For immediate assistance, contact our nearest representative:

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C. E. WINCHELL
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Phone: Rittenhouse 5226

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P. A. MORSE
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MOTORS 1 TO 1500 H. P. • GENERATORS 1 TO 1000 K. W.

BURKE A.C. & D.C. Motors & Generators

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Use

THE GENUINE *Squires*

REDUCING VALVES

for dead - end service, or wherever close regulation is required.

Also Steam and Air Traps, Pump Governors and Boiler Feed Water Controllers.

THE C. E. SQUIRES CO.

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Mr. Fillet Weld WINS *on* ~~IN~~ A WALKWAY

• When it comes to running a walkway, Mr. Fillet Weld is a winner every time. That's what makes **BATES • GRATES** the right choice for walkways and open steel flooring in your plant.

These championship qualities go into BATES • GRATES

- **Longer lasting**—the Fillet Weld and Hex Bar construction makes **BATES • GRATES** more durable. Their strength exceeds all former standards set for open steel flooring and stair treads.
- **Safer**—the combination of Hex Bars and Fillet Welding provides clean, crisp, SAFE grating.
- **Better ventilation and light**—the reflecting bevels of the Hex Bars, with 90° corners, allow maximum transmission of light and air.

for open steel flooring, stair treads, floor armor and bridge decking . . .
Get a Bid from BATES

Damp-Proof Basements

Leaks, water seepage in concrete walls can be stopped instantly — permanently, with FLEXTITE. This amazing material actually seals against water pressure. Will convert wet basements into bone-dry useful space. Efficient as a plaster coat for waterproofing and dampproofing. Used in elevator pits, tunnels, dams, concrete water tanks, retaining walls. In reconstruction work, broken pillars and beams can be quickly restored, even reshaped, with FLEXTITE.

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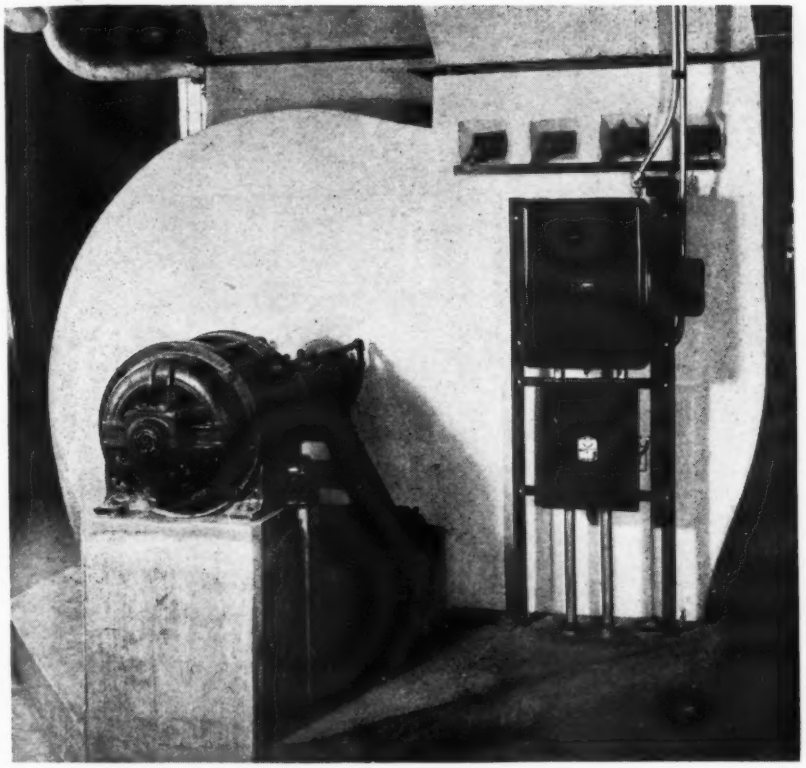
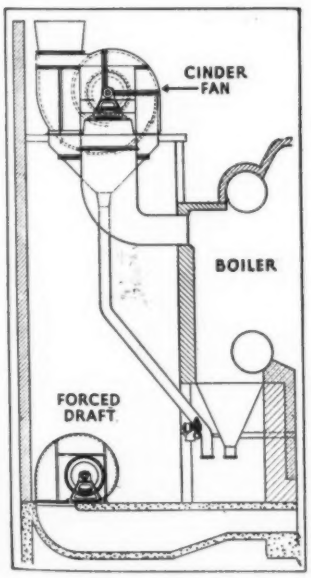
Put Your Induced Draft Fans on Double Duty



An increasingly large number of industrial power plant operators are putting induced draft fans on "double-duty." In addition to draft service, these fans are also taking a large percentage of dust and soot out of the smoke.

This naturally results in better public relations with less dirt in the plant and the product.



Buffalo Cinder-Eliminating Induced Draft Fans are simple, efficient, and easy to operate. They require no extra equipment. They do an excellent job of cinder removal.

Why not get details, no obligation.

BUFFALO FORGE COMPANY

488 BROADWAY BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

CINDER ELIMINATING INDUCED DRAFT FANS

COMPRESSED AIR LINE PURIFICATION YOUR PROBLEM?

Here's the Answer...

The new Bird-White Pur-O-fier A-1 assures you of positive elimination by turbo-rotor centrifugal action of all free moisture, oil and foreign matter in small compressed air or gas systems. It operates with from 1 to 5 cubic feet of air (1 to 75 p.s.i.) and for intermittent operation is extremely sensitive.

Among many other uses this new unit is ideal for protecting air pressure operated machinery and instruments from corrosion and gumming.

For complete specifications and applications write today for Bulletin No. 11.

Bird-White Pur-O-fiers are also available in other models for purification of large volumes of compressed air or gas. Ask for Bulletin No. 10.

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Dept. PM, 3119 West Lake St.
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PATENT APPLIED FOR

BOILERS "SNAP OUT OF IT!"

MARION SOOT BLOWERS **modernize boilers right now! They do this work:**

- **Increase boiler capacity and flexibility**
- **Save 5 to 10 percent on fuel bills**
- **Do the job mechanically and quickly**
- **Blow out soot deposits without injury to baffles**

● **Soot slows boilers down. *MARION SOOT BLOWERS* eliminate stubborn soot with minimum waste of steam. Type "F" for water tube boilers blows in any length of arc from 15 to 345 degrees. No lugs, stops, pawls, nor pins. "Keeps on Rollin' " to right or left as desired. Favorites with skilled engineers and power plant owners, *MARION SOOT BLOWERS* are made for all sizes and types of boilers. Parts are interchangeable. Continuous service with low replacement and repair cost.**

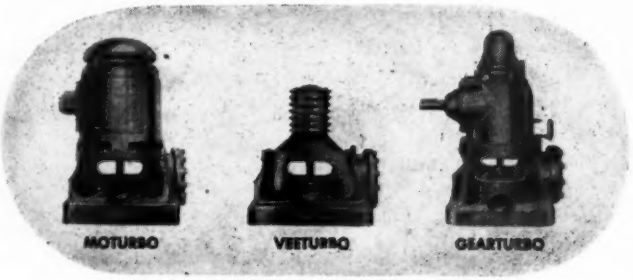
Write for Specifications and Prices
Save Coal, Time and Worry

THE MARION LINE

Marion Machine, Foundry and Supply Co. • Marion, Indiana, U. S. A.

The Time Is Approaching When You Can Again Get a *PEERLESS*

● Like thousands of others, you've probably put a new water pump at the top of your *must* list of improvements. *"Will I be able to get a Peerless?"* you ask. The answer is sounding more cheerful every day. *Yes, you will,* in the not too distant future. The big Peerless back-log of orders is being worked on 24 hours a day. The situation improves daily. But don't wait to place your order until your need becomes desperate. Consult with the nearest Peerless Distributor now and get your order on file. We'll do everything within our power to deliver your needed pump as soon as we can. Certain types can be delivered sooner than other models—so check with Peerless now.



The Peerless Line is Most Complete

Deep Well Turbine Pumps
Vertical Types
Oil or Water Lubricated
Capacities: 15 to 30,000 g.p.m.

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For General Service
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Also Jet and Water King Domestic Water Systems

PEERLESS PUMPS

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COCHRANE Deaeration SAVES!

Deaeration of boiler feedwater is one of the big items of economy in power plant operation.

Cochrane Deaerators of varying sizes, designs and construction have been protecting the boiler plants of industry for many years. The feed piping, economizers, water walls and tubes of these boilers are effectively protected by Cochrane Deaeration, which removes both dissolved oxygen and soluble gases, and at the same time produces savings in heat and fuel by heating the water to the boiling point.

COCHRANE CORPORATION **3106 N. 17th ST., PHILADELPHIA 32, PA.**

COCHRANE

SOFTENERS · DEAERATING SOFTENERS · DEAERATORS · METERS · STEAM SPECIALTIES

SPRAFINE NOZZLES

PERFECT
BALANCED
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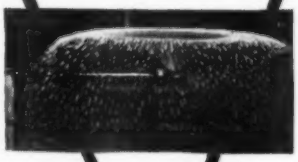

IMPROVE YOUR TOWER

IMPROVE YOUR SPRAY - POND

CLIFFORD H. CARR CO.

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AS QUICK AS A FLASH YOU CAN KNOW THE EXACT MEASUREMENT OF YOUR VALUABLE STORED LIQUIDS With **LIQUIDOMETER** *Tank Gauges*

100% AUTOMATIC

APPROVED BY UNDERWRITERS' LABORATORIES

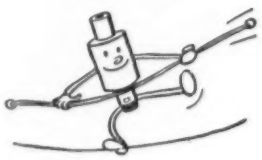
WRITE for COMPLETE DETAILS

"LIQUIDS WORTH STORING ARE WORTH MEASURING"

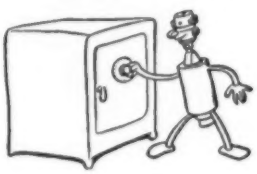
THE **LIQUIDOMETER** CORP.
39-16 SKILLMAN AVE., LONG ISLAND CITY, L.N.Y.

Put these features to work for YOU

BALANCED ROTOR



POWER SEAL



NEW FORM CUTTERS

COMPLETELY CLEANS TUBES FASTER WITHOUT TUBE DAMAGE

Balanced Rotor—eliminates friction in the Airetool motor so that all power is directed against the load.

Power Seal—increases motor efficiency, prevents power waste, produces constant torque at low speeds, eliminates dead centers and allows motor to be loaded down to 50 rpm without stalling.

New Form Cutters—quickly and thoroughly clean tubes without tracking or damage to tubes.

. . . . these are the features found

EXCLUSIVELY IN AIRETOOL TUBE CLEANERS

that make possible faster, more thorough cleaning of tubes without damage.

Airetool tube cleaners are offered in a variety of styles and sizes to efficiently meet every tube cleaning problem. Made for tubes 1/2 in. to 24 in. I. D.; straight or curved.

Write the Airetool Mfg. Co., Dept. P
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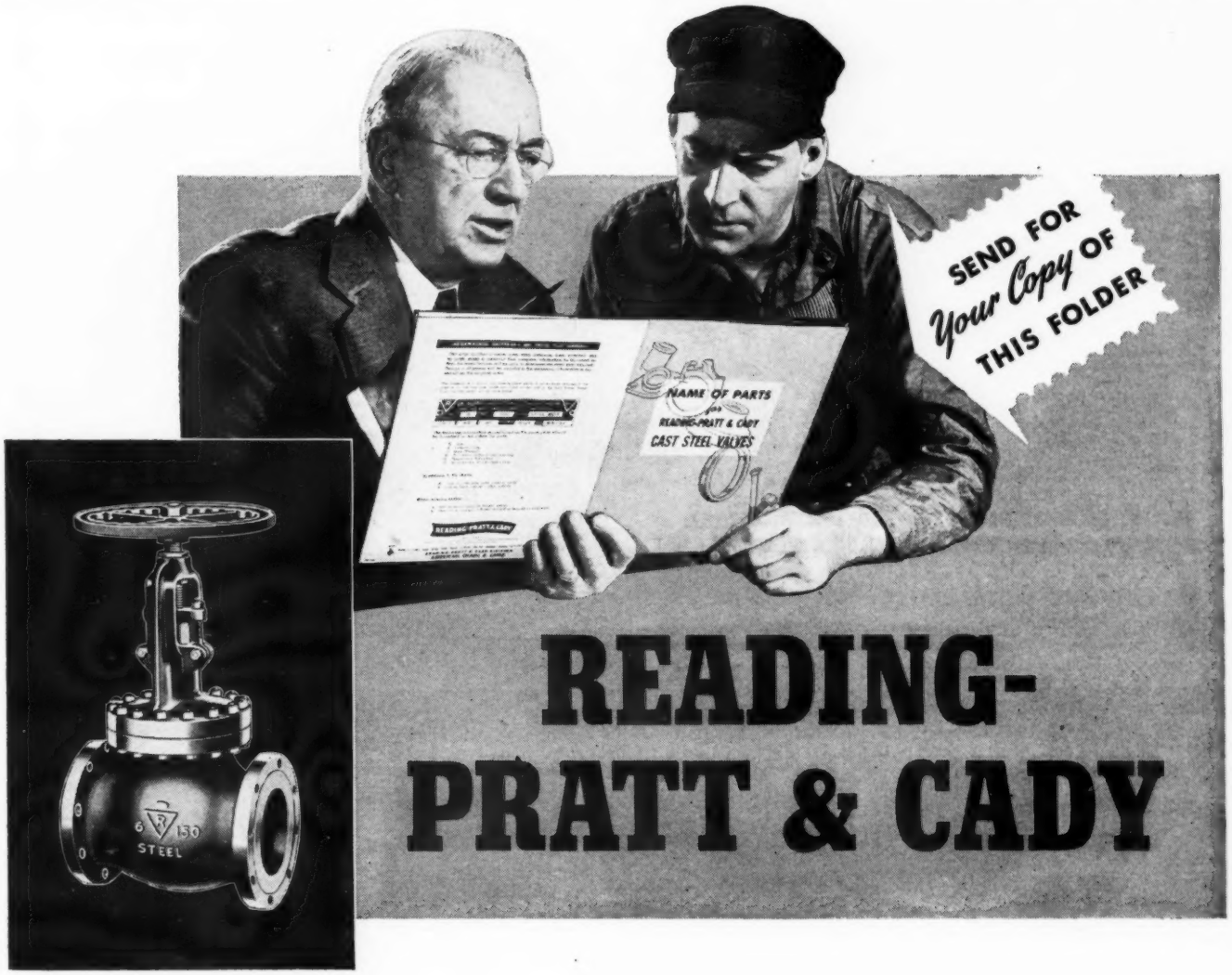
for Free Helpful Bulletins

AIRETOOL MANUFACTURING COMPANY

This Simplifies Ordering STEEL VALVES and PARTS



This six-page, file-size folder contains much useful information in convenient form. Here are the standard names of all component parts of steel gate, globe and check valves. Cut-away pictures make it a very simple matter to identify each part. Send for your copy.

Reading-Pratt & Cady distributors are located in principal cities.

Reading Cast Steel Valves and Fittings • Pratt & Cady Brass and Iron Valves
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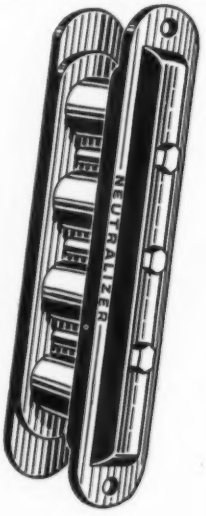
READING-PRATT & CADY DIVISION
AMERICAN CHAIN & CABLE

CASE Histories: Boiler Maintenance

"Done More . . . . . Than I was Told It Would Do"

"Previous to the time we installed Electro Neutralizers our boilers were in an unusually bad condition . . . having ¼" of old hard scale and the top coated with rust. The rust is fast disappearing as well as the scale; parts of the boilers are now showing bare metal", wrote J. E. Osborne, Mgr., Swiss Cleaners & Dyers, Louisville. Sold on money back guarantee and users protected by insurance policy. Sold by leading Supply Jobbers nationwide, or write for literature and recommendations without obligation. The Electro Chemical Engineering Co., Louisville 2, Ky.



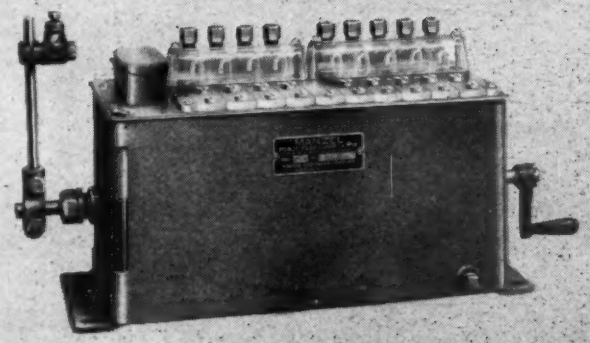
Aids in control of pH value of water. Removes old scale, lengthens boiler life, increases steam efficiency, reduces repair cost. Makes for lower fuel consumption. Reduces the eating of metal, pitting, foaming, carry-over and all types of corrosion including electrolytic action. Produces mineral-free water and purer steam, helps to prevent new scale formation.

ELECTRO CHEMICAL ENGINEERING CO., LOUISVILLE 2, KY.

ELECTRO-NEUTRALIZER

FOR WATER CORRECTION AND POSITIVE BOILER-SCALE ELIMINATION

MANZEL FORCE FEED LUBRICATORS



We are Specialists in Force Feed Lubrication with nearly 50 years experience. Send us your problems.

Manzel Brothers Co.

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THIS DEXTER OUTFIT PAID FOR ITSELF IN A MONTH!

A DEXTER CASE HISTORY

When the Patterson Parchment Paper Company of Bristol, Pa., looked over their valve situation in 1937, they decided to give Dexter Valve Reseating Equipment a trial.

THE PROBLEM WAS THIS: As in most paper mills, Patterson Parchment had a large number of gate valves on steam and water lines. Many of these were not seating properly, allowing wasteful losses, adding to mounting costs. Replacement with new valves meant a large expenditure in money and installation time. Good management and common sense dictated the logical solution — reseating these valves right on the line, making them perform like new again, with the Dexter Valve Reseating Machine.

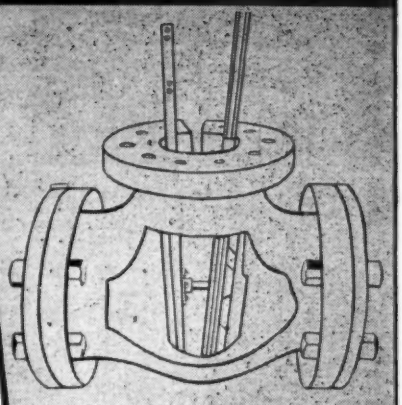
HERE'S WHAT PATTERSON PARCHMENT DID ABOUT IT:

"We refer to the 2-16-C Dexter Gate Valve Reseating Outfit . . . . . which we purchased in September, 1937.

"This equipment has operated to our entire satisfaction and we feel that the machine *paid for itself* within a month or so after the initial purchase was made by reclaiming gate valves used in our plant.

"Our experience with the operation of the Valve Reseating Outfit has been of the best and we have found that during the past seven years or more we have only had occasion to buy a few minor replacement parts.

"We take this opportunity to recommend this equipment for the purpose for which we use it."



Dexter Reseating Machines and Cutters are made in various models to fit globe, gate and pump valves in many sizes. One man does the job right on the line in a few minutes' time with a Dexter outfit. Write for full information today — no obligation.

V-2

THE LEAVITT MACHINE CO. · 100 East River St., Orange, Mass.

7 USES FOR LUMNITE IN POWER PLANTS

1. **Ash Pit and Cinder-Catching Linings**—Heat-Resistant LUMNITE concrete withstands wear and corrosion in both wet-type and dry-type units.
2. **Coal Bunker Linings**—LUMNITE concrete resists abrasion and corrosion.
3. **Flue and Duct Linings**—LUMNITE concrete resists abrasion of flue gases and fly ash. Provides insulation where required.
4. **For Steel Stacks**—Jointless LUMNITE linings protect steel stacks from corrosion. Their insulating properties improve efficiency.
5. **For Brick Chimneys and Linings**—LUMNITE mortar resists attack of sulphurous gases and corrosive condensate formed in intermittent and low-temperature operation.
6. **Castable Refractories, made with** LUMNITE —used for jointless walls and arches, baffles, burner blocks, door linings, stoker settings and general refractory purposes.
7. **Overnight Structural Concrete**—For rapid maintenance, LUMNITE provides full-strength concrete in 24 hours or less, even in freezing weather.

WAYS TO REDUCE OUTAGES AND CUT MAINTENANCE COSTS

Ready-to-Use

CASTABLE REFRACTORIES

Castable Refractories are factory-prepared mixtures of LUMNITE and selected aggregates. They are mixed with water on the job and cast into place for door linings, arches, baffles or furnace walls. Special shapes can be cast in molds, ready for use within 24 hours.

Castables to meet different temperature and insulation needs are made by refractory manufacturers and sold by their distributors.

Specify Castables

MADE WITH LUMNITE

Coal Bunker lined with Corrosion-Resistant Concrete. Steel or concrete bunkers, bins and silos can be protected from abrasive wear and corrosive attack with LUMNITE linings—cast-in-place, plastered or applied with a cement gun.

Operators of steam power plants keep LUMNITE on hand to take care of a variety of maintenance jobs. Write today for detailed information on the many uses of LUMNITE in power plants.

THE ATLAS LUMNITE CEMENT COMPANY

(United States Steel Corporation Subsidiary)

Chrysler Building • New York 17, N. Y.

We Are Just As Anxious As You Are To Produce More Eagle Oilers We're Doing Our Utmost

Many types of Eagle Oilers are now available . . . others will be as soon as it is possible to make them again. Some materials are still hard to get . . . other conditions not entirely under our control, delay our production. We ask your patience a little longer. We assure you we are doing our utmost to resume regular items for peacetime demands. It won't be long until you can get the Eagle Oilers you want.

Order from your distributor

EAGLE MANUFACTURING COMPANY

WELLSBURG, WEST VIRGINIA

TOUGH RESURFACER

FOR BROKEN Concrete or Wood Floors DURABLE! Easily Installed!

Resurface or patch broken concrete floors with tough RUGGEDWEAR resurfacer. Here's a material which will stand up under the most punishing traffic conditions. Simple to install—no chopping or chipping required. Merely sweep out the spot to be repaired—mix the material—trowel it on. Holds solid and tight right up to irregular edge of old concrete. Provides a firmer, tougher, smoother, more rugged wearing surface. Used indoors or out. Dries fast.

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Please send me complete RUGGEDWEAR information and details of FREE TRIAL OFFER—no obligation.

Name .....

Company .....

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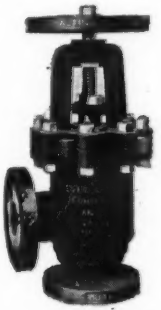
A STURDY *Everlasting valve team* FOR YOUR BOILER BLOW-OFF

Install this EVERLASTING "Duplex" Boiler Blow-off Valve Unit and you'll get PROMPT, DEPENDABLE valve teamwork . . . and no more blow-off troubles!

This is the SEALING Valve

The EVERLASTING Lever-operated Valve (shown on the LEFT of the Unit) provides QUICK opening and closing. An easy, quarter-turn short-stroke movement of the lever assures full-pipe-size opening with straight-through flow . . . or drop-tight closing — *instantly!* And each opening or closing action regrinds the disc on the seat, maintaining the famous Everlasting drop-tight seal.

The EVERLASTING Wheel-operated Angle Valve (on the RIGHT of the Unit) bears the shock of the blow-off force. It supplies enduring resistance to the erosive action of abrasive solids usually present in boiler blow-off water. No pockets anywhere in this valve for the lodgement of solids. A sturdy long-life team—this EVERLASTING Duplex Valve Unit! And it meets all code requirements for your boiler blow-off service. Built with various features, for pressures to 600 lb., sizes 1½" to 2½". Either valve available separately.



This is the BLOWING Valve

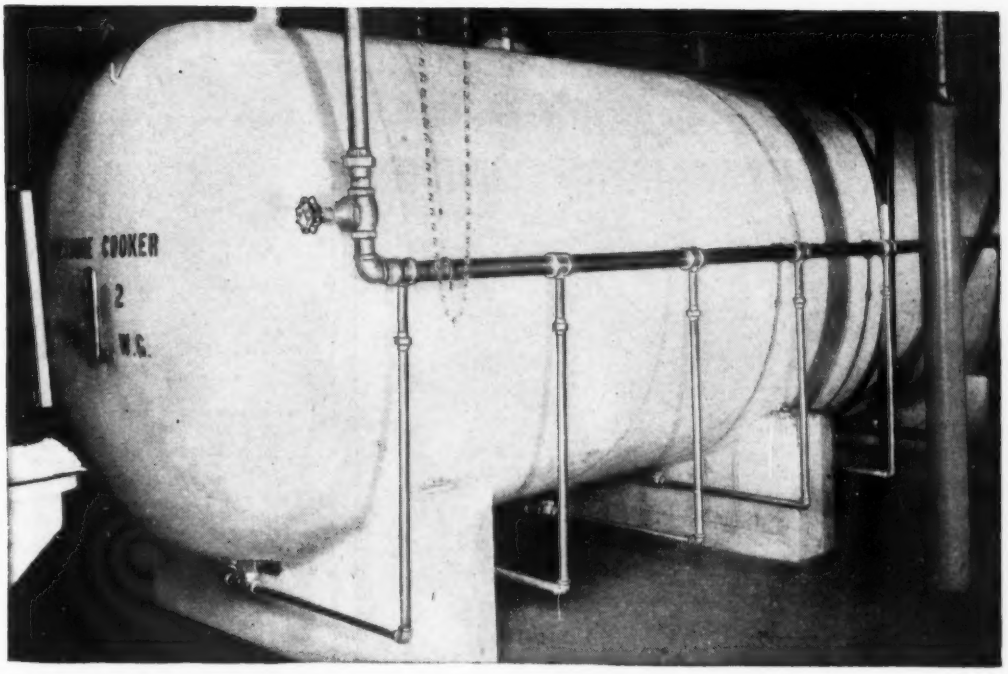
Write today for EVERLASTING Bulletin E-100 giving the complete story—no obligation!

EV-257

EVERLASTING VALVE CO., 49 Fisk St., Jersey City 5, N. J.

Everlasting Valves

FOR EVERLASTING PROTECTION



The high Rust Inhibition of Eagle Super "66" Insulating Cement pays you an extra dividend!

Yes, Eagle Super "66" Insulating Cement gives you an important "extra"—a rust inhibitive quality that helps prolong the life of your heated metal equipment, thus saving costly repairs and replacements. Extensive tests have proved that in addition to doing a tremendously efficient job of insulating, Super "66" actually inhibits rust!

"Springy Ball" structure. Super "66" is made up principally of "Springy Ball" Mineral Wool pellets, literally honeycombed with dead air cells. These dead air cells effectively block the escape of heat—give Super "66" extremely low thermal conductivity.

"Springy Ball" Structure

Super "66" withstands a full range of temperatures up to 1800° F., and if not used at temperatures above 1200° F., *can be removed, remixed and reused!*

All-purpose — easy to apply. Super "66" can be applied easily and quickly to most any size or shape surface. Just mix with water, spot over surface and trowel to desired thickness.

High coverage. As high as 65 sq. ft. per 100 lbs. wet. Shrinkage, which occurs in thickness only, is less than 15%.

Send for data sheets. They contain complete technical information about Eagle Super "66." Available on request.

FREE Manual! Gives examples of how industrial insulation effects large fuel savings. Includes Heat Loss Estimate Sheet for your use. Write for your copy.

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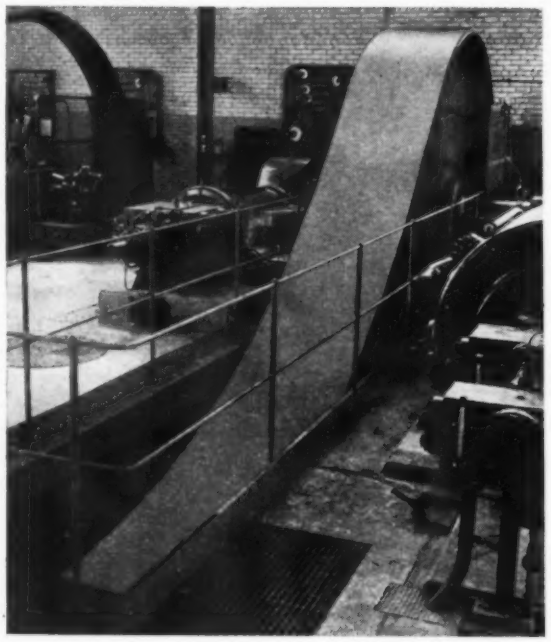

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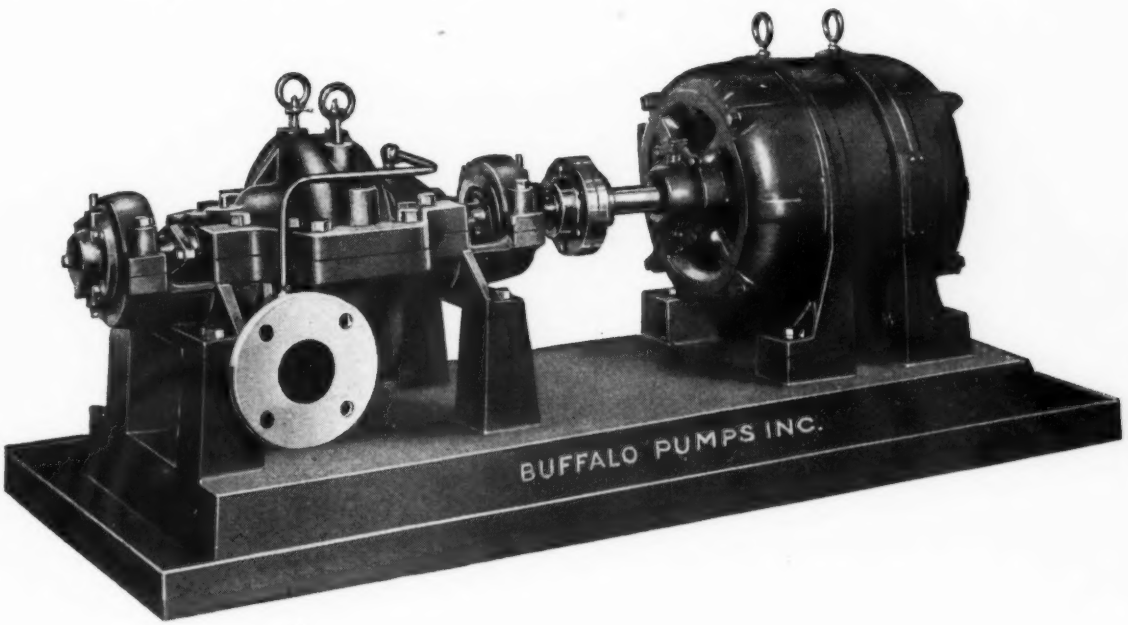

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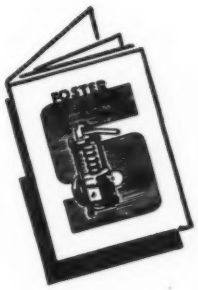

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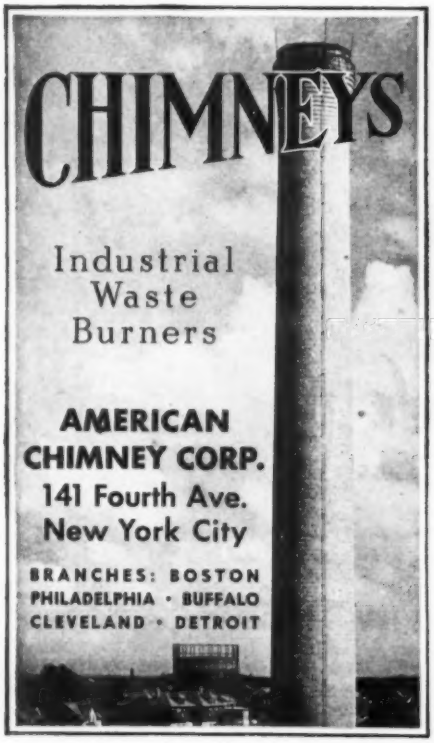

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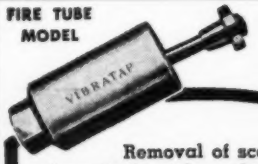

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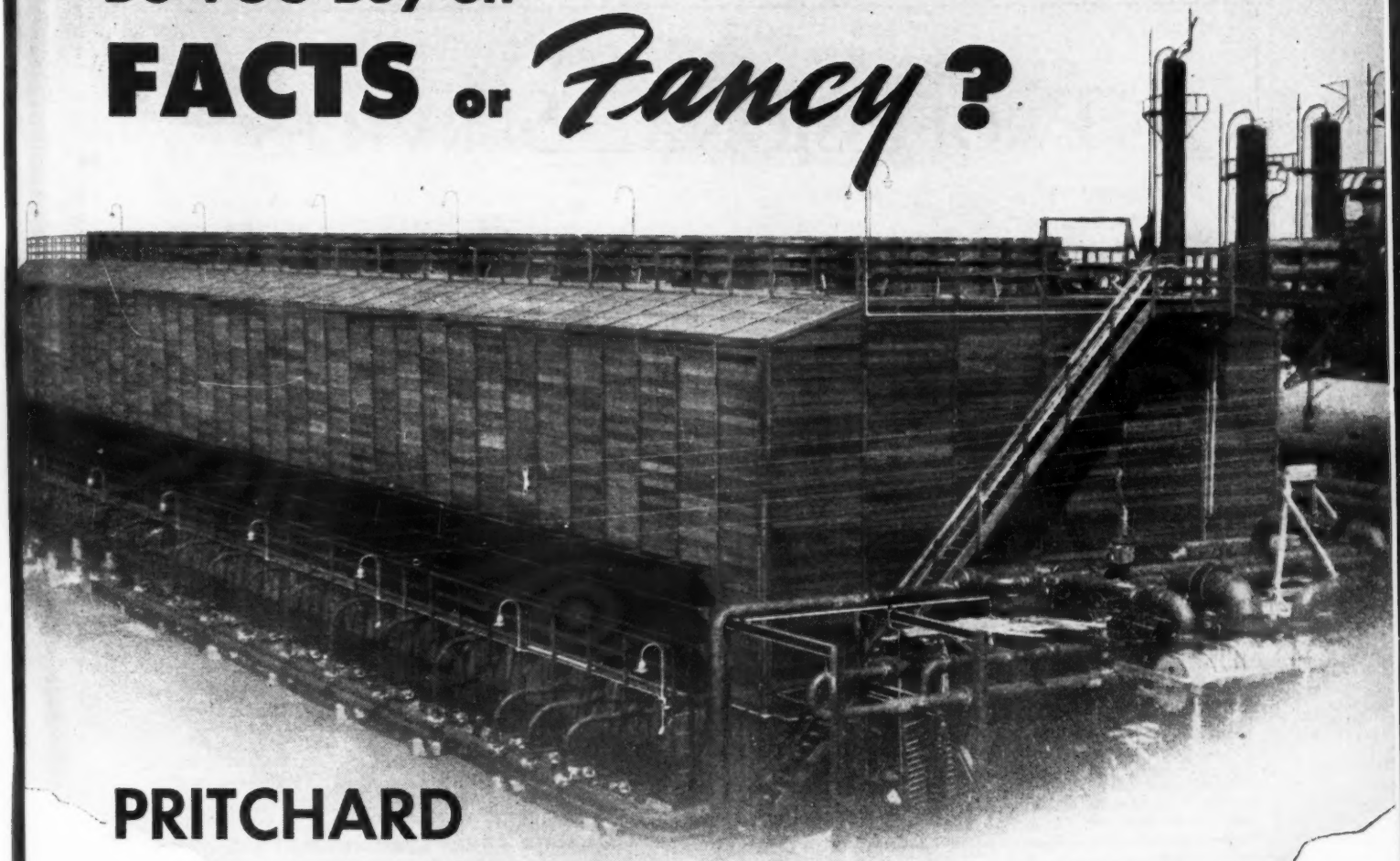

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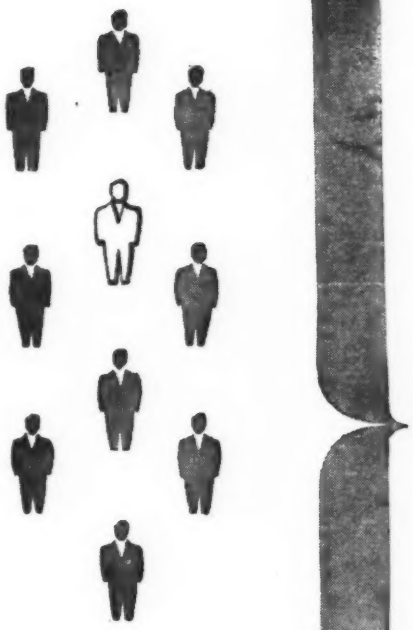

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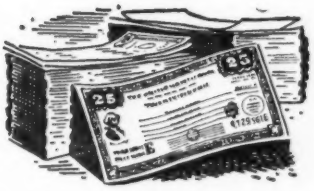

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POSITIONS WANTED (full or part-time individual salaried empolyment only), ½ the above rates.
PROPOSALS, 75 cents a line an insertion.

INFORMATION
BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:
The advertising rate is $8.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches —to a page. P.

NEW ADVERTISEMENTS received by April 11th will appear in the May issue, subject to limitation of space available

POSITIONS VACANT

POWER PLANT machinery inspection engineer wanted by leading boiler and machinery insurance company. Locations: Spartanburg, South Carolina, and Chicago, Illinois. Technical graduates not over 38 preferred. Practical experience in the operation or maintenance of prime movers and electrical equipment necessary. Permanent position with good future possibilities. In reply, give age, employment record and salary expected. P-991, Power, 330 W. 42nd St., New York 18, N. Y.

WANTED: MECHANICAL and chemical engineer with experience in heat transfer work in the oil industry or other process work. Old established concern located near Chicago offers excellent opportunities because of expansion in this field. P-106, Power, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED: DRAFTSMEN and tracers from beginners up to designers by an organization of long standing in boiler and general heat transfer work for power plant and marine fields. Excellent opportunities due to expansion program. Location near Chicago. P-107, Power, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED: MECHANICAL Engineer. With experience in steam power plant layout, power piping and plant survey work. A good opportunity for the right man with a small consulting firm in the Midwest. Give age, outline of experience, education and salary expected. P-119, Power, 520 N. Michigan Ave., Chicago 11, Ill.

SELLING OPPORTUNITY OFFERED

SALESMAN WANTED: Position open for home office sales engineer also for salesmen at branch office in Chicago and New York. Applicants must be experienced and thoroughly familiar with centrifugal pumps. Good permanent opportunity. Write fully. Confidential. Dean Hill Pump Company, 4000 E. 16th Street, Indianapolis 7, Indiana.

WANTED

Graduate Electrical or mechanical engineer with rounded experience in steam-generating plants and some knowledge of small diesel and ice plants, to become assistant to manager of production of a public utility located on the middle Eastern Seaboard with 30,000 to 40,000 kw. steam plant capacity and 40,000-50,000 customers. Excellent permanent opportunity and attractive salary for qualified man of 27 to 35 interested in consulting and supervisory work. Write, giving experience, salary expected, etc.

P-118, Power
330 West 42nd St., New York 18, N. Y.

WANTED

MECHANICAL ENGINEER

FOR STEAM POWER PLANT DESIGN

An unusual opportunity for a young engineer well grounded in steam power plant design to join a growing organization

WESTCOTT & MAPES, INC.
NEW HAVEN, CONNECTICUT

WANTED

STRUCTURAL ENGINEER

FOR DESIGN OF STRUCTURAL STEEL AND REINFORCED CONCRETE STRUCTURES

An unusual opportunity for a young man experienced in the design of structural steel and reinforced concrete to join a growing organization.

WESTCOTT & MAPES, INC.
NEW HAVEN, CONNECTICUT

EMPLOYMENT SERVICE

SALARIED POSITIONS $2,500-$25,000. This thoroughly organized confidential service of 36 years' recognized standing and reputation carries on preliminary negotiations for supervisory, technical and executive positions of the calibre indicated, through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

MECHANICAL ENGINEER, age 42, professional license state of Washington, with 18 years experience in steam plant operation, steam and electrical utilization equipment installation, operation, and maint., plant supervision, sales work, cost analysis of electrical and steam services, desires permanent industrial connection in Western United States. Will furnish references. PW-108, Power, 520 N. Michigan Ave., Chicago 11, Ill.

ENGINEERING GRADUATE: with 7½ years experience in power plant installations and hydraulic control systems. Desires position with firm designing industrial hydraulic equipment and systems; or power plant layout and equipment designs and installations. PW-111, Power, 330 W. 42nd St., New York 18, N. Y.

POWER PLANT Chief Engineer: age 41, over 20 years experience, 7 as chief engineer responsible for operation and maintenance of large industrial power plant. Familiar with management of modern high pressure steam generators, pulverized coal, stokers, turbines, engines and auxiliary equipment. Go anywhere. PW-120, Power, 330 W. 42nd St., New York 18, N. Y.

POSITIONS WANTED

MECHANICAL ENGINEER: Veteran Naval Officer, B.S. in M.E. in 1939. 1½ years operation and maintenance in power plant, 2 years supervising installation of machinery in Government Powder plants. Experienced in operation of machine tools, welding and woodworking machinery. Desire an engineering position with a future. A. H. Eikelberger, Orofino, Idaho.

POWER PLANT operator: 15 years practical experience in steam electric power plant operation, 37 years old, high school graduate, with some studying, married, with family, and desires similar position with progressive firm. PW-121, Power, 520 N. Michigan Ave., Chicago 11, Ill.

BUSINESS OPPORTUNITY

INDUSTRIAL CHEMIST with thirteen years experience desires to purchase going water treatment business. Will consider partnership. BO-122, Power, 330 W. 42nd St., New York 18, N. Y.

SALES ENGINEER

Familiar with power plants, to take full charge of long established branch office. This opening made available through the expansion of our business and promotions in our organization. Locations Chicago, Philadelphia, or Detroit.

The Dampney Company of America
Hyde Park, Boston 36, Mass.

WANTED

EQUIPMENT ACCOUNTS

One or two additional accounts by experienced concern, able to sell, service, and erect power plant equipment. Minnesota and adjacent territory.

RA-100, Power
330 West 42nd St., New York 18, N. Y.

Mechanical Engineer

seeks sales engineering connection in power field. B.S.M.E., M.S.M.E., and M.E. degrees. Age 48. Registered. Theoretical and practical experience.

SA 117 Power
330 West 42nd St., New York 18, N. Y.

MORE PROFITS

FOR YOUR COMPANY LESS WORRY AND EXPENSE

FOR YOU

TO sell your business for cash to a reputable and experienced operating concern with substantial capital may be the best thing for both the company and you.

WE are principals (not brokers) with a record of successful operating experience. Present company personnel retained wherever possible.

• *ALL discussions and negotiations strictly confidential*

Box 1234, 1474 Broadway, N. Y.

Equipment Wanted — page 252

WHEN YOU BUY USED EQUIPMENT LOOK FOR HEMPHILL'S

WHEN YOU buy Hemphill-owned Equipment, there is PREJUDGED VALUE packed in every crate . . . because OUR OWN buyers and electrical engineers have not only OK'd it for GOOD equipment . . . our REBUILDING experts have also tested and OK'd it to make sure that in workmanship and performance it meets MANUFACTURERS' standards.

HEMPHILL STANDARDS ARE MAKERS STANDARDS

MOTOR GENERATOR SETS

1—150 KW. 125 Volt Westinghouse, Squirrel Cage
2—100 KW. 230 Volt General Electric, 440 volt, 3 phase, 1200 RPM. Sq. Cage
1—80 KW. 230 volt 3 unit Crocker-Wheeler Synchronous 220 volt

TURBO GENERATORS

1—600 KW. Terry dual bleeder condensing Turbine only
1—300 KW. 125/250 Volt General Electric non-condensing
1—200 KW. General Electric, 3 phase, 60 cycle, 220 volt cond.
1—200 KW. General Electric, 3 phase, 60 cycle, 220 volt cond.
1—30 KW. 135 volt, Allis-Chalmers, non-cond.

ALTERNATORS

1—500 KW. 3600 RPM. 600 volt, General Electric D.C. exciter
1—200 KVA 3600 RPM. 240 volt, Allis-Chalmers D.C. exciter
1—180 KW. 514 RPM, 550 volt, Westinghouse
1—165 KW. 514 RPM, 2400 volt, Electric Mach.
1—62½ KW. 3600 RPM. 220 volt, Allis-Chalmers
1—40 KW. 1800 RPM. 550 volt, General Electric
1—35 KW. 1200 RPM. 240 volt, Columbia Electric D.C. exciter
1—31.3 KVA. 1200 RPM. 120/208 volt, American D.C. exciter
1—12.5 KVA. 1200 RPM. 240 volt, Westinghouse, D.C. exciter

MOTORS—VARIABLE SPEED

230 VOLTS

2—200 H.P. 425/212 RPM. General Electric MPC
2—100 H.P. 950/1170 RPM. General Electric RC-37
1—40 H.P. 700/1000 RPM. Sprague L.C.
1—30 H.P. 400/120 RPM. General Electric R' C-204
1—30 H.P. 225/900 RPM. Crocker Wheeler CMC
1—25 H.P. 650/2200 RPM. Westinghouse SK-110L
1—25 H.P. 500/1500 RPM. General Electric RF-12
1—25 H.P. 400/1200 RPM. Westinghouse SK
2—25 H.P. 300/900 RPM. Electro Dynamic
1—15 H.P. 300/1200 RPM. General Electric RLC-2024
1—13/18 H.P. 350/1200 RPM. Electro Dynamic
3—11½ H.P. 500/1500 RPM. Westinghouse
1—7½/10 H.P. 500/1500 RPM. Reliance
1—6/7.5 H.P. 450/1800 RPM. Crocker Wheeler CMC
1—5 H.P. 500/1500 RPM. Reliance
1—5 H.P. 600/1200 RPM. General Electric LC
1—5 H.P. 450/1800 RPM. Crocker Wheeler CM
1—5 H.P. 400/1600 RPM. Diehl K6
1—5 H.P. 225/900 RPM. Electro Dynamic

TRANSFORMERS

1—1000 KVA. Auto Transf. 4150 V. 3 Ph. 4 wire to 2400 V. 2 Ph.
2—400 KVA. General Electric, 4156-250/480 volt, Scott taps
3—100 KVA. Westinghouse 11430/250 volt
3—100 KVA. General Electric 13200/250 volt
3— 75 KVA. General Electric 13500/750/440 volt
1— 75 KVA. General Electric, 3 phase, 4156Y-125/216
2— 50 KVA. Pittsburgh 7500/15000 V. 110/220 v.
2— 15 KVA. General Electric 2300-115/230 volt

GASOLINE DRIVEN D. C. GENERATOR SETS

2—25 KW. 125 volt
1—30 KW. 125 volt
1—120 KW. A.C. 240 volt, 3 phase

MOTORS 3 PHASE 60 CYCLE

SQUIRREL CAGE

1—400 H.P. 1200 RPM. Westinghouse 220 volt
1—150 H.P. 1750 RPM. General Electric 1K 440 volt
1—150 H.P. 400 RPM. General Electric 1-17 440 volt
1—125 H.P. 1750 RPM. Cont. Electric 2200 volt
2—100 H.P. 1800 RPM. General Electric IK 440 volt
1— 90 H.P. 380 RPM. Crocker-Wheeler 550 volt
1— 75 H.P. 690 RPM. Westinghouse 550 volt
1— 60 H.P. 900 RPM. Howell Mfs. Co. SC. 220 volt
2— 50 H.P. 900 RPM. Fairbanks-Morse H. 220 volt
1— 50 H.P. 680 RPM. Westinghouse 220 volt
2— 50 H.P. 565 RPM. Westinghouse 440 volt
1— 50 H.P. 575 RPM. General Electric IK 220 volt
1— 50 H.P. 514 RPM. General Electric 1QK 220 volt
2— 25 H.P. 1800/1200/900/600 U. S., 440 volt, 3 phase

MOTORS 3 PHASE 60 CYCLE

SLIPRING

1—500 H.P. 900 RPM. Lincoln 440 volt
1—350 H.P. 293 RPM. General Electric MT-424 440 volt
1—250 H.P. 600 RPM. General Electric IM 2200 volt
1—225 H.P. 1800 RPM. General Electric I-E 220 volt
1—200 H.P. 600 RPM. Crocker Wheeler S.R. 440 volt
1—200 H.P. 600 RPM. Westinghouse CW 220 Volt
1—150 H.P. 1750 RPM. Westinghouse CW 220 volt
1—150 H.P. 900 RPM. General Electric IM 440 volt
1—100 H.P. 900 RPM. General Electric MT vertical 220 volt
1—100 H.P. 720 RPM. Westinghouse CW 440 volt
1—75 H.P. 1200 RPM. General Electric MT Vertical 220 volt.
1— 75 H.P. 900 RPM. General Electric ITC 220 volt
1— 60 H.P. 575 RPM. Allis-Chalmers 220 volt
1— 40 H.P. 1150 RPM. Cont Electric SA85 220 volt
1— 40 H.P. 1130 RPM. General Electric MT 2200 volt

MOTORS D. C. 230 VOLTS

2—450 H.P. General Electric MPL 250 volt 400 RPM.
1—250 H.P. 750 RPM. Electro Dynamic 230 volt
1—125 H.P. 1725 RPM. General Electric RC—230 volt.
1— 75 H.P. 575 RPM. General Electric C 230 volt
4— 50 H.P. 700 RPM. Crocker Wheeler CM 230 volt
2— 30 H.P. 1150 RPM. General Electric RC-31 230 volt
1— 30 H.P. 1100 RPM. General Electric RC-12 230 volt
1— 30 H.P. 750 RPM. General Electric RC-14 230 volt
1— 30 HP. 625 RPM. General Electric C 230 volt
1— 25 H.P. 1150 RPM. General Electric CD-93 230 volt
1— 25 H.P. 600 RPM. Westinghouse SK 230 volt
1— 20 H.P. 800 RPM. General Electric RC-12 230 volt
1— 15 H.P. 350 RPM. Diehl G-312 230 volt

SYNCHRONOUS MOTORS

2—160 H.P. 1800 RPM. Electric Machinery, 2200 volt.

MISCELLANEOUS

2—2100 Gallon Pumps Dayton-Dowd 190 foot head.

JLHC

THIS SEAL IS YOUR GUARANTEE

"FOR POWER"

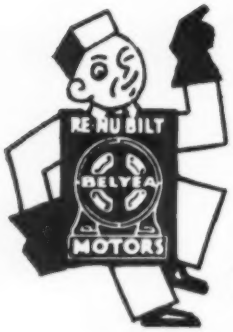
J.L. HEMPHILL & CO.

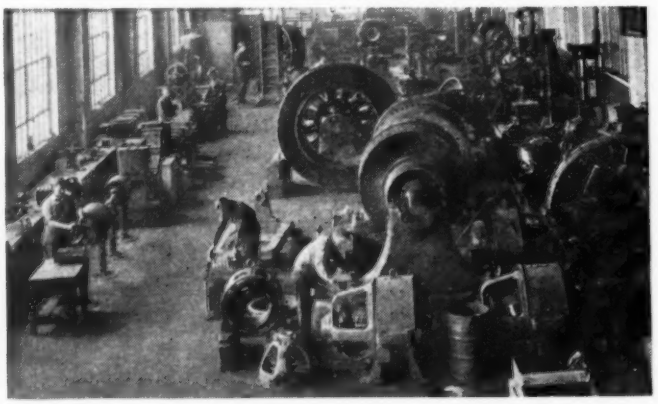
1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600

Typical!





This Explains Our Statement...

What BELYEA RE-NU-BILT *Signifies*

It means YOU—the buyer and user—get the benefit of 38 years of experience in selecting and buying quality equipment, rebuilding it, and testing it the highest of standards. The list shown below is only a sample of present stock.

"SUCCESSFUL OPERATION GUARANTEED"

MOTOR GENERATOR SETS

3 phase—60 cycle

1—1500 KW. G.E. 275 V. D.C. to 2100 HP. 4400/2200 V. Syn. with exciter.

1—250 KW. Whse. 250 V. D.C. to 550 Kva. 550 V.

1—175 KW. Whse. 250 v. D.C. to 312 Kva., 2300 v. Syn. with exciter.

2—150 KW—Whse. 600 V. D.C. to 200 HP—2200 V.

1—150 KW Whse. 3 unit (2) 75 KW 125 V. Gen. D.C. to 200 HP—2300 V. Ind.

1—75 KW GE 125 V. D.C. to 120 HP—2300/4000 V. Ind.

1—50 KW GE 125 V. D.C. to 75 HP—2300/4000 V. Ind.

1—45 KW. Whse. 250 V. D.C. to 75 HP. 440 V.

1—26.4 KW W.E. 33 v. 800 amp. D.C. to 41.5 HP. 220 v. Sq. Cg.

1—19.8 KW W.E. 33 v. 600 amp. D.C. to 32 HP. 220 v. Sq. Cg.

SPECIAL
1—500 KW—GE 250 V D.C. to 700 HP—2300/4150 Syn. Motor—3 phase—25 cycle with Controls.

TRANSFORMERS—60 Cycle

Qu.	Kva.	Make	Ph.	Type	Voltages
3	1667	Pitts.	1	OISC	13200x2300
1	1050	G.E.	3	WCTH	11000x445/222½
4	525	G.E.	1	HJ	2300x445
4	500	Pitts.	1	OISC	13200x2300
2	333	Pitts.	1	OISC	2400x220
1	300	Pitts.	3	OISC	4150x208/120
3	200	G.E.	1	HLLD	27600x115/460
2	200	G.E.	1	HKDD	13800x220/440
1	200	Whse.	1	JK	6600x220/440
3	200	G.E.	1	HJ	2300x408/204
1	200	G.E.	2-3	Auto	2500x2500
1	200	G.E.	1	H	2300x115/230
3	100	G.E.	1	HJDD	13200x445/226
3	100	Whse.	1	OISC	13200x250

A. C. MOTORS

3 Phase—60 Cycle

SLIP RING

Qu.	H.P.	Make	Volts	R.P.M.	Desc.
1	2500	G.E.	6600	253	MT
1	800	Al. Ch.	440	885	ANY
1	600	Cr. Wh.	2200	507	131 AQ
1	600	Whse.	440	400	CW
1	350	G.E.	4000/2300	253	MT-442Y
1	250	G.E.	4000	257	MT-424Y
1	225	G.E.	550	720	IM-17
1	200	G.E.	440	450	IM-3 Brg.
1	200	G.E.	2200	600	IM
1	160	G.E.	550	720	IM
1	100	G.E.	550	685	MTC-5552

SQUIRREL CAGE

1	725	G.E.	13800/2300	600	KT
1	400	G.E.	2200	1175	IE-15B
1	300	G.E.	440	900	IK
1	200	G.E.	550	580	IK
2	200	G.E.	2300	1175	IK
1	200	G.E.	440	580	IK
1	200	Al. Ch.	2300	1175	
2	175/112	G.E.	440	900/720	IK
1	150	Whse.	550	400	CS-594A
3	150	G.E.	440	1200	K-63258B. Brg.

SYNCHRONOUS

2	2100	G.E.	2200 4400	514	ATI
1	800	G.E.	4600/2300	900	TS-7650
2	700	Whse.	4600/2300	1200	
1	600	Al. Ch.	2200	720	
1	125	G.E.	2300	900	ATI
1	75	G.E.	220	600	TS-7556

SYNCHRONOUS CONDENSER

1	5000	Whse.	2300/4000	900	

ROTARY CONVERTER

3 PHASE—60 CYCLE

Qu.	Kw.	Make	Speed	D.C.V.	Trans. V
1	1500	Whse.	720	600	2300
1	1500	Whse.	600	600	11500
1	1250	G.E.	720	250	2300
1	1000	G.E.	900	600	13200
1	1000	Whse.	900	600	11000
1	750	Whse.	720	250	6600/2300
1	500	Whse.	1200	600	13200/2300

3 PHASE—25 CYCLE—BOOSTER TYPE

2	1500	G.E.	500	225/275	13200/6600

All units can be furnished with A. C. & D. C. control

SPECIAL
1—2000 amp., 3 pole, 15000 V. Conduit. type F-120-15 D, 230 V Sol. operated OCB —1000 000 uninterrupting Capacity.

D. C. MOTORS

Qu.	H.P.	Make	Type	Volts	Speed
2	1250	G.E.	MPC	500	130
1	800	G.E.	MPC	550	600
2	700	G.E.	MCF	600	150/525
1	650	G.E.	MPC	250	115/145
2	625	G.E.	MPC	500	130
1	500	G.E.	MPC	230	900
1	300/400	Sprague	TLC	250	1325/2500
3	350	G.E.	MPC	230	450
1	300	G.E.	MPC	230	275/550
1	300	G.E.	DMC	230	400/600
2	300	Cr. Wh.	CCM-151H	230	630/700
1	250	G.E.	MPC	230	400/500
1	250	Al. Ch.		230	525
1	250	Whse.	SK	230	275/690
2	135/175	G.E.	MCF	230	450/1050
1	150	G.E.	MPC	230	250/450
2	130	Cr. Wh.	CMC-65H	550	1200
2	125	G.E.	CO-1832	230	625

TURBO GENERATOR SETS

1—500 KW—Whse. 625 KVA. 440 v. 3 ph. 60 cy. 3600 RPM with Parsons 145/175 lbs. condensing turbine with jet condenser and accessories.

1—75 KW Ridgeway 250 V. D.C. with Terry 180 lb. with 12 lb. back pressure, 2000 RPM.

38TH YEAR OF SERVICE

WE OWN WHAT WE ADVERTISE IT HAS TO BE GOOD!

BELYEA COMPANY, INC.

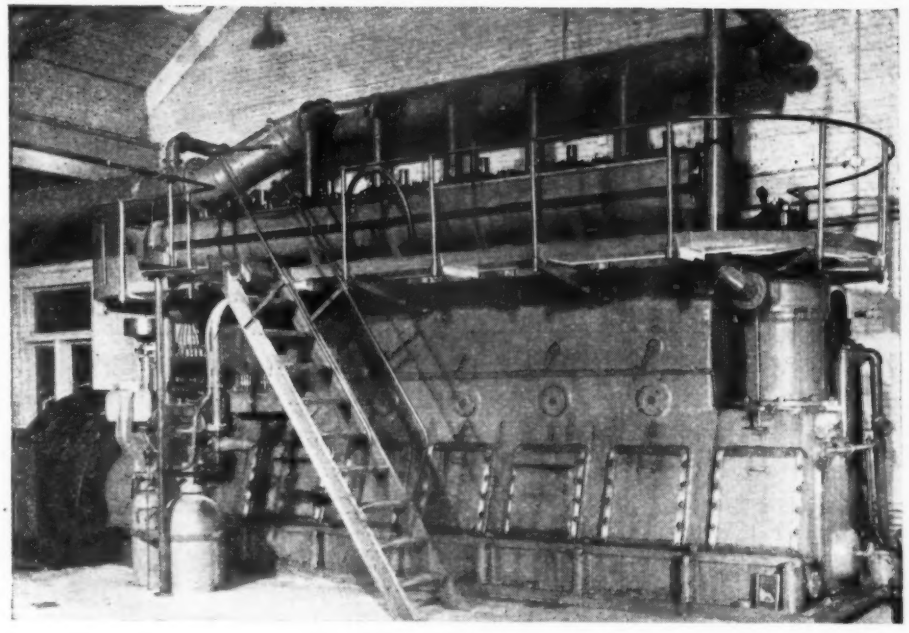
We Buy for Stock — for CASH
What Surplus Do You Have?
PHONE—JOURNAL SQUARE — 2-3334
Also
N. Y. CITY LINE — RECTOR 2-7150

Main Office and Shop

43 HOWELL STREET

JERSEY CITY 6, N. J.

POWER PLANT MACHINERY



1000 KVA Ideal generator 3 phase 60 cycle 2300/4000 volts, 300 RPM direct connected to 1200 HP McIntosh & Seymour 6-cylinder diesel engine, 4 cycle, 300 RPM.

INSTALLED NEW 1930

Excellent Condition

Can be shown in operation

Actual Photograph

1000 KVA McINTOSH & SEYMOUR DIESEL ENGINE GENERATOR UNIT

TURBINE UNITS

3 phase 60 cycle

12500 KVA Wstg. 2400 V. Cond. 200#
10000 KVA G.E. 4000 V. Cond. 200#
6250 KVA G.E. 2300 V. Cond. 175#
5000 KVA G.E. 4000 V. Cond. 200#
3750 KVA G.E. 480 V. Cond. 200#
2500 KVA Wstg. 2300 V. Cond. 200#
1875 KVA Wstg. 240 V. Bleed. 400#
1875 KVA Wstg. 240 V. Non. 400#
1250 KVA Allis 480 V. Non. 150#
937 KVA Allis 2300 V. Bleed. 175#
625 KVA Wstg. 480 V. Bleed. 150#

UNIFLOW UNITS

3 phase 60 cycle

1000 KVA Skinner 2300 V. 150#
750 KVA Skinner 2300 V. 175#
500 KVA Skinner 480 V. 150#
375 KVA Skinner 240 V. 150#
312 KVA Chuse 480 V. 150#
280 KVA Ames 480 V. 150#
260 KVA Skinner 480 V. 150#
225 KVA Skinner 2400 V. 165#
150 KVA Ames 240 V. 150#
120 KVA Ames 240 V. 165#

DIESEL UNITS

3 phase 60 cycle

500 KVA Fair.Mor. 2300 V. 257 RPM
375 KVA DeLav. 2300 V. 300 RPM
350 KVA Fair.Mor. 2300 V. 300 RPM
300 KVA Fair.Mor. 2300 V. 257 RPM
250 KVA DeLav. 480 V. 277 RPM
250 KVA Buckeye 480 V. 514 RPM
220 KVA DeLav. 4000 V. 300 RPM
200 KVA Ven. Sev. 240 V. 327 RPM
175 KVA Buckeye 240 V. 450 RPM
156 KVA Buckeye 240 V. 514 RPM
118 KVA Winton 240 V. 400 RPM
100 KVA Ven.Sev. 240 V. 327 RPM

WATER TUBE BOILERS

43,000 lbs/hr. Sterling (2) 250#, Stoker.
25,000 lbs/hr. Sterling (2) 425#, Pulverizer.
20,000 lbs/hr. Springfield 200#, Oil.
9,000 lbs/hr. Heine (2) 225#, Coal.

UNIFLOW UNITS

Direct Current

600 KW Skinner Vert. 250 V. 150#
300 KW Skinner 250 V. 150#
200 KW Skinner 250 V. 150#
200 KW Ames Vert. 125/250 V. 150#

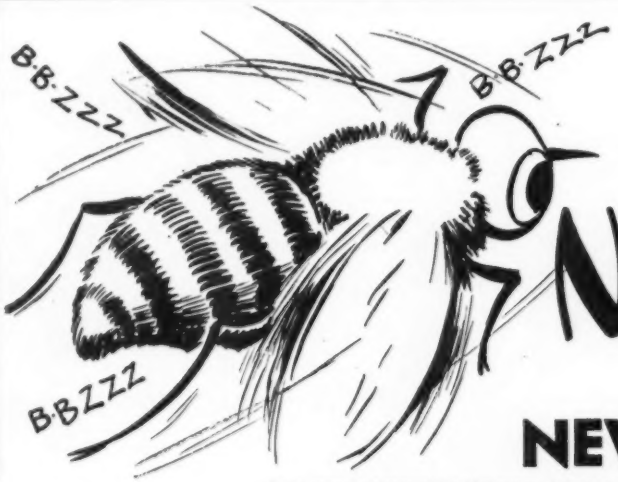
MOTOR GENERATORS

3 phase 60 cycle

1800 KW G.E. Syn. 275 D.C. 13200 A.C.
400 KW G.E. Syn. 275 D.C. 400 A.C.
300 KW C.W. Syn. 250 D.C. 4000 A.C.
200 KW G.E. Syn. 275 D.C. 2300 A.C.
150 KW C.W. Syn. 125 D.C. 4150 A.C.

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. Telephone: MAin 9514 CLEVELAND 14, OHIO



PUT THE BEE ON US . . .

NEW MOTORS

IN STOCK

NEW *SPECIAL* NEW

600 KW WESTINGHOUSE MOTOR GENERATOR SET—250V-1200 RPM.
800 H.P. Sync. Motor, 4160V. 60 Cy., 3 PH, exciter, 25 Kw. 250V. Sk. FACTORY BUILT NEVER USED.

NEW STANDARD OPEN SQUIRREL CAGE 3/60/220-440V. B. B.

Quan.	H.P.	Frame	R.P.M.	Quan.	H.P.	Frame	R.P.M.	Quan.	H.P.	Frame	R.P.M.
14—	1	204	1200	5—	15	326	1800	2—	60	504	1800
18—	1	204	1800	5—	15	365	1800	2—	60	505	1200
5—	1½	204	1800	6—	20	364	1800	2—	75	505	1800
7—	2	224	1800	9—	20	404	1200	1—	75	5084	1200
5—	2	225	1200	15—	25	365	1800	2—	100	5084	1800
6—	3	223	1800	5—	25	404	1200	2—	100	5084	1200
9—	3	254	1200	2—	30	405	1800	2—	125	5085	1800
15—	5	254	1800	8—	30	444	1200	2—	125	6085	1200
12—	5	284	1200	2—	40	444	1800	1—	150	5085	1800
5—	7½	284	1800	2—	40	445	1200	1—	200	6085	1800
10—	7½	324	1200	2—	50	445	1800	1—	200	6085	1200
5—	10	324	1800	3—	50	504	1200				
5—	10	326	1200								

NEW—TOTALLY ENCLOSED FAN COOLED 3/60/220—440V. B. B.

Quan.	H.P.	Frame	R.P.M.	Quan.	H.P.	Frame	R.P.M.	Quan.	H.P.	Frame	R.P.M.
14—	1	203	1800	5—	10	324	1800	2—	50	445	1800
5—	1	204	1200	5—	10	326	1200	3—	50	504	1800
23—	1½	204	1800	5—	15	326	1800	2—	60	504	1800
5—	1½	204	1200	5—	15	365	1200	2—	60	605	1200
8—	2	224	1800	2—	20	364	1800	2—	75	505	1800
6—	2	225	1200	14—	20	404	1200	3—	75	508	1200
18—	3	225	1800	9—	25	365	1800	2—	100	508	1800
7—	3	254	1200	7—	25	405	1200	2—	100	508	1200
2—	5	254	1800	6—	30	405	1800	1—	125	6085	1800
5—	5	284	1200	5—	30	444	1200	2—	125	6085	1200
7—	7½	284	1800	3—	40	444	1800	1—	150	6085	1800
12—	7½	324	1200	5—	40	445	1200	1—	150	6085	1200

GEAR HEADS

75—¼ Hp 1/110/220 280 RPM
13—½ Hp 220-60-3 86.2 RPM
1—30 Hp Slip Ring M126 RPM
4—40 Hp Slip Ring M86 RPM
196 OTHERS IN STOCK

COMPENSATORS—STOCK NEW

50 HP 220-60-3 — 50 HP 440-60-3
75 HP 220-60-3 — 75 HP 440-60-3
100 HP 220-60-3 — 100 HP 440-60-3
100 HP 220-25-3 — 125 HP 440-60-3
125 HP 220-60-3 — 150 HP 440-60-3

M. G. SETS

3—30 Hp. G.E. KT512 1750 RPM 440-V direct connected to 24 KW, RC31Y 60-V
1—2000 amp plates, B.B. double conn. 25 Hp. 440-V, 60-cy. 3 ph.

D. C. MOTORS 230-V.

25 Hp. Elec Dyn. TE 850/1250 BB
15 Hp. West. SK, 1100 RPM
15 Hp. West. SK90 825/1650 RPM
15 Hp. Rel. 66T BB Shunt, 1150/1500
11½ Hp. West SK80L 600/1800
15 Hp. RC 29 1150 RPM
10 Hp. RC29-A 1150 RPM.
7½ Hp. RC 8 1150 RPM
5 Hp. West SK 850 RPM
5 Hp. West. SK, 400/1200 RPM
2—5 Hp. RC 313 690 RPM
4 Hp. GE B. 1700 RPM
3—2 Hp. RC 1150 RPM
3 Hp. RC 1800 RPM
2 Hp. Diehl 1800 RPM
1½ Hp. RC 1800 RPM
5—1 Hp. RC 1200 RPM
1 Hp. RC 1200 RPM
6—1½ Hp. L.A., 650/2100 Hp.

DC—230V—CRANE MOTORS

2—85 H.P. G.E. MD106 450 RPM
5—45 H.P. G.E. MD104½ 500 RPM
2—17 H.P. G.E. MD103 800 RPM
—27½ H.P. G.E. MD 1200 RPM with brakes
3—5 H.P. G.E. MD101 825 RPM
12—3½ H.P. CO1803 750 RPM
2—3½ H.P. G.E. CO1803 750 RPM with brakes

115V—DC

1½ H.P. RC 1750 RPM
2 H.P. West. CD 1750 RPM
1 H.P. G.E. D 850 RPM
3—2 H.P. LA 850 RPM
2 H..P. LA 1850 RPM
1 H.P. GE D 1140 RPM
1 H.P. G.E. BD 500/1500 RPM

MOTORS—AC 60 CY. 3 PH. Used

14—200 H.P. Wagner RP2 440-1800 RPM
6—100 H.P. Elec. Mchy 220/440 1200 RPM BB
1—40 H.P. FM TE 440 V 900 RPM BB
40 H.P. Triumph 220 V 860 RPM
30 H.P. KT 336 440 V 720 RPM
30 H.P. KT 332 440 V 900 RPM
20 H.P. W-CS 440 V 400 RPM
20 H.P. KT 327 440 V 1200 RPM
20 H.P. KT 440 V 860 RPM
15 H.P. KT 954 220/440 V 1800 RPM
10 H.P. Cleveland 440 V 720 RPM BB
10 H.P. W-CS 440 V 680 RPM
10—30 H.P. Allis Chalmers AR 440 V. 900 RPM

156 MOTORS 1 H.P. UP TO 10 H.P.

THE ABOVE SUBJECT TO PRIOR SALE

Guarantees: 1 year by the original manufacturers.

WRITE-WIRE-PHONE YOUR INQUIRIES TO

Electric Motor & Machinery Co.

MONROE 1388-1389 **P.O. BOX 1273** **ROCHESTER 7, N. Y.**

1132-38 MT. HOPE AVE.

Dependable Rebuilt Electrical Equipment

1 YEAR GUARANTEE

3 Ph. Squirrel Cage Motors

Qu.	H.P.	Make		Speed
4	150	G.E.	KT-5478	1750
6	150	West.	CS-771.1S	1755
1	125	West.	CS	1150
1	125	West.	CS	690
1	147	West.	25 cyc.	715
2	100	G.E.	BTA-440V.	375/750
1	100	West.	CS	575
1	90	Burke	EM7	1150
1	75	Cr-Wh.	BB-505	1750
1	70	G.E.	Synch.	1200
1	85	G.E.	FT-529	3600
1	75	G.E.	2300 V.	1800
1	75	West.	CCL	870
1	75	Al. Ch.		860
1	60	Burke		575
3	60	G.E. & West.		690
1	50/25	G.E.	KG-504	1750/885
1	50	G.E.	KT-326	1750
1	50	Star	A-75	1750
1	50	Al. Ch.		1160
1	50	West.	CCL	1150
1	50	G.E.	KT-342	865
1	50	Cr. Wh.	122Q	865
1	50	G.E.	KT-346	690
1	50	West.	CS	580
1	50	G.E.	I-14	495
1	46	W. E.		150/900
1	40	G.E.	KT-332	1140
2	40	G.E.	KT-336	860
1	40	Triumph	TR	690
1	40	G.E.	KT-346	690
1	40	W.E.		150/900
1	35	Wagner		850
1	35	West.	CS	685
1	30	U.S.	Vert.	3450
1	30	Cr. Wh.		870
1	30	Watson		850
1	30	West.	CS	850
1	30	West.	CCL	690
1	25	G.E.	KT-503	1750
1	25	Triumph	BL-11S	1750
1	25	G.E.	KT-302	1735
1	25	Wagner	Fy. Welch.	1200
1	25	Wagner	Vert.	1160
5	25	West.	CS	1160
1	25	Century	AS-35	870
1	25	G.E.	IK	870
1	25	Wagner	Fy. Welch.	720
1	20	G.E.	KT-312	1700
1	20	G.E.	Vert.	1750
1	20	R & M	K-207	1160
1	20	West.	CS	1150
2	20	F-M		1150
1	20	G.E.	Vert.	1175
1	20	Al. Ch.		870
1	20	Diehl		860
1	20	Al. Ch.		860
1	20	West.	C.I.	690
1	15	G.E.	KT-752	1750
1	15	Wagner	Fy. Welch	1800
1	15	El. Spec.	Synch.]	1800
1	15	West.	CCL	1750
1	15	G.E.	KT-312]	1150
1	15	Howell		1150
1	15	Al. Ch.		1150
1	15	G.E.	KT-502	1170
4	15	G.E.	Vert.	1150
1	15	Lincoln		1150
4	15	West.	MS	1150
2	15	West.	CS-365	1160
1	15	G.E.	Vert.	870
1	15	G.E.	KT-512	870
1	15	Wagner	15VPR	860
1	15	Wagner	Fy. Welch.	720
1	15	West.	CS-504	415

NEW
WAGNER
Splash Proof NEMA Frame
3 ph 60 cy 440 volt
MOTORS

195 —	5 H.P.	1750	RPM
24 —	5 H.P.	1150	RPM
160 —	7½ H.P.	1750	RPM
44 —	7½ H.P.	1150	RPM
115 —	10 H.P.	1750	RPM
9 —	10 H.P.	1150	RPM
15 —	15 H.P.	1750	RPM
81 —	20 H.P.	1750	RPM
6 —	25 H.P.	1750	RPM

NEW
TOTALLY ENCLOSED FAN
Cooled NEMA Frame
MOTORS
WAGNER-STAR and G.E.

10 —	5 H.P.	1150	RPM
38 —	5 H.P.	1750	RPM
55 —	7½ H.P.	1750	RPM
6 —	7½ H.P.	1150	RPM
1 —	20 H.P.	1150	RPM
18 —	25 H.P.	1750	RPM
4 —	25 H.P.	1150	RPM

2 Ph. Squirrel Cage Motors

Qu.	H.P.	Make		Speed
1	100	West.	CS-663C	1750
1	70	G.E.	Synch.	1200
1	75	G.E.	IQE	1750
1	50	Lincoln	C-15	870
1	50	G.E.	IQ	870
1	40	Al. Ch.		870
1	35	Al. Ch.		870
1	30	West.	CCL	1150
1	30	Wagner	BP	1140
1	25	Burke		870
3	25	G.E.	IQL	1150
1	25	West.	CCL	1150
1	15	F-M		1750
1	15	Wagner		1750
1	15	G.E.	KQ-502	1150
1	15	West.	CS	1155
1	15	Al. Ch.		1130
1	15	West.	CS-572	860
1	15	G.E.	IQ	690

A.C. Slip Ring Motors

Qu.	H.P.	Make	Type	Speed
1	250	G.E.	IM	600
1	150	Lincoln		600
11	150	El. Dy.	L-263	1770
1	125	Al. Ch.		695
1	112	G.E.	ITC	720
1	100	F-M	BA	720
1	79	G.E.	IM	1150
1	79	West.	CW	1170
1	75	Al. Ch.	Hoist	575
1	64	G.E.	MTO-552	585
1	60	West.	CW-956A	290

A.C. Slip Ring Motors

Qu.	H.P.	Make	Type	Speed
1	50	West	CW	1150
1	50	West	CW	870
1	50	G.E.	IM	720
1	50	G.E.	MT	600
1	52	G.E.	ITC	860
1	50	Al. Ch.		865
1	50	G.E.	MT-342	860
1	40	West.	HF	850
1	40	Lincoln	IXL	690
1	40	G.E.	MT-352	570
1	35	Al. Ch.		870
1	35	Burke	DMB-7	720
1	30	G.E.	ITC	1200
1	30	G.E.	M-526	1150
1	30	G.E.	MQ-332	870
1	30	West.	CI-574A	870
4	30	West.	CI-582C	870
2	30	G.E.	MT-542	690
2	25	Al. Ch.		870
1	25	Howell	SRS-420	870
1	25	G.E.	IM	565
1	20	West.	CW	870
1	20	G.E.	MT-332	600
1	15	G.E.	MT-502	1130
1	15	West.	CW	870
1	15	G.E.	MT-512	845
1	15	Al. Ch.		680
2	15	G.E.	ITC-5010	695
1	15	G.E.	MQ-332	670

A.C. Generators

Qu.	K.W.	Make	Voltage	Speed
1	150	G.E.	240/480	600
1	100	West.	240/480	600
1	106	KW El.Mchy.	220/440	1200
1	50	G.E.	208/120	1200
1	50	F-M	240/480	1200
1	50	El. My.	208/120	900
1	30	Burke	220/440	900
2	30	KW Century	208/120	1200

230 Volt D.C. Motors

Qu.	H.P.	Make	Type	Speed
1	350	West.	SK	340/425
3	75	West.	SK151	250/1000
1	75	Burke	AM-158	575
1	60	G.E.	C-Inter.	480/1150
1	50	G.E.	RC-19	400/1200
1	45	Diehl	K-10	850
1	40	G.E.	DLC	1050
2	35	West.	SK-120	1150
1	35	G.E.	RLC-204	440/880
2	35	West.	SK-160	400/600
1	30	G.E.	RC-32	1100
1	30	West.	SA	500/1500
3	25	G.E.	RC-31	1150
1	25	West.	SK	1100
1	25	Reliance	92T	1150
1	25	L-A	FNA-1043	900
1	25	A-L		850
1	25	Rel.	MS	500/1500
1	25	Rel.	H3	400/1200
1	25	G.E.	RF	400/1200
3	20	G.E.	RF	500/1500
1	20	G.E.	RF	400/1200
1	20	G.E.	CD-83	1200
1	20	R. & M.		1160
1	20	G.E.	RC-11	1150
1	20	El. Dyn.	7½-S	950
3	20	West.	SK-110L	750
1	20	West.	Hoist	700
1	20	West.	SK-120	300/1200
1	15	Rochester		3450
1	15	West.	SK-83	1150
2	15	G.E.	RC	1150
1	15	G.E.	CD-Vert.	900
1	15	G.E.	CD-85	850
2	15	G.E.	RC-30	850
1	15	Sprague	D	700
1	15	West.	SK	675/1350
1	15	West.	SK-100L	600/2500
1	9	L-A	Baler	1750
4	10	G.E.	RC	1150
2	10	G.E.	CD-75	1150
1	10	Diehl		900
1	10	G.E.	RC	29/850
1	10	G.E.	CD-83	850
1	10	Roth		800
1	10	Diehl	LS-14	750
1	10	West.	Elevator	700
1	10	G.E.	CVC	700
1	10	West.	SK	600/1200
1	10	G.E.	RLC	500/1500
1	10	West.	SK	500/1500

230 Volt D.C. Motors

Qu	H.P.	Make	Type	Speed
1	10	El. Dyn.		450/1800
2	10	G.E.	RF-10	400/1600
2	10	West.	SA	400/1200
1	10	West.	SK-90	400/1200
1	10	Diehl		200/247
1	7½	Sturt.	TF	3600
1	7½	El. Dyn.	2S	1750
1	7½	G.E.	RC	1150
6	7½	West.	SK-40	1150
1	7½	G.E.	CO-1804	
1	8	L-A	Baler	1200
2	7½	West.	SK	850
2	7½	G.E.	RC	850
1	7½	West.	SK-60	850
2	7½	G.E.	RF-9	600/1800
1	7½	G.E.	RF-10A	600/1500
1	7½	West.	SK-90	650/1300
1	7½	El. Dyn.	3S	550/1650
1	7½	G.E.	RF-10	450/1800
1	7½	G.E.	RF-10	450/1600
1	7½	G.E.	RF	450/1800
2	7½	West.	SK-70	400/1600
1	7½	Al. Ch.		350/1050
1	7½	L-A	Baler	

110 Volt D.C. Motors

Qu.	H.P.	Make	Type	Speed
1	45	G.E.	RC	1100
2	10	Lincoln	I-SC	3500
1	10	L-A		3500
1	10	E. Dyn.	3S	1100
1	10	West.	SK-70	1150
1	10	Reliance		400/1600
2	10	Diehl		230
1	7½	G.E.	CVC	725
1	7½	El. Dyn.	5S	450/900
1	7	El. Dyn.		600/1200

D.C. Generators

KW	Make	Voltage	Ampere	Speed
300	Burke (2)	250/125	1200	900
300	West. (2)	250	1200	900
250	G.E.	125	2000	720
100	G.E. MPC	125	800	1150
50	G.E. (2)	125	400	1150
50	G.E.	250	200	870
40	Cr-Wh.	250	160	870
30	El. Dyn.	600	50	1150
20	G.E.	125	240	1150
25	G.E.	125	200	1150
20	West.	250	100	1150
10	West.	250	40	1150
10	West.	125	80	1150
7½	G.E.	250	30	1150
7½	West.	125	60	1150

AIR COMPRESSORS

12½"x12"	American
10"x6"	Gardner
9"x8"	Ingersoll Rand
9"x8"	Sullivan
7"x6"	Ingersoll Rand

9—150 H.P. Gen. Elec. and West. Latest Type Ball Bearing Squirrel Cage Motors. 3 ph. 60 cy. 220 or 440 volts 1765 RPM.

D.C. to A.C. Generators 1 to 25 K.V.A. 115 and 230 V.D.C. to 1 ph. and 3 ph. 110-220 & 440 V. A.C.

THIS IS A PARTIAL LIST ONLY!

L. J. LAND & COMPANY

146 GRAND STREET, NEW YORK 13, NEW YORK

Established 1910 **CAnal 6-6976**

TYPICAL ITEMS IN STOCK

NEW AIR COMPRESSOR

2-stage 1855 C.F.M. 23 & 14 x 14 Worthington Type DC-2,

300 H.P. G. E. Synchronous motor driven, 2300/3/60/277 Unity P.F.

With 5 step capacity control. Air filter and 54 x 14 Air Receiver.

ALSO A LARGE STOCK OF NEW TANK-MOUNTED COMPRESSOR UNITS 1½ TO 10 H.P.

REBUILT AIR COMPRESSORS

Two-Stage Synchronous Motor Driven

CFM	Make	Size	Max. Pressure
782	Ingersoll-Rand	15 x 9½ x 10	100
862	Chicago Pneumatic	14¼ x 9½ x 7	100
1302	Chicago Pneumatic	20 x 12 x 14	125
1545	Ingersoll-Rand	21 x 13 x 14	100
1850	Chicago Pneumatic	23 x 13 x 14	125
2195	Ingersoll-Rand	26 x 16¼ x 18	100
3078	Ingersoll-Rand	30 x 18 x 21	100

Single Stage V-Belt Driven

67	Chicago Pneumatic	6 x 6	150
173	Ingersoll-Rand 9 x 8	9 x 8	100
211	Worthington	9 x 9	100
215	Ingersoll-Rand	10 x 8	75
311	Chicago Pneumatic	12 x 8	45
350	Worthington	11 x 12	100
368	Sullivan	12 x 10	100
386	Chicago Pneumatic	14 x 12	115
528	Ingersoll-Rand	14 x 12	100
528	Pennsylvania	14 x 12	100

Two-Stage Belt Driven and Direct Connected

327	Ingersoll-Rand	11 x 7 x 10	100
877	Ingersoll-Rand	17 x 10½ x 14	100
1085	Chicago Pneumatic	19 x 11 x 12	100
1302	Ingersoll-Rand	20 x 12½ x 16	100

NEW ELECTRIC MOTORS

100— 5 H. P. Squirrel Cage 3/60/440/1800

60—7½ H.P. Squirrel Cage 3/60/440/1800

10—10 H.P. Squirrel Cage 3/60/440/1200

100—10 H.P. Squirrel Cage 3/60/440/1800

18—15 H.P. Squirrel Cage 3/60/440/1200

40—15 H.P. Squirrel Cage 3/60/440/1800

5—20 H.P. Squirrel Cage 3/60/440/1200

15—20 H.P. Squirrel Cage 3/60/440/1800

8—25 H.P. Squirrel Cage 3/60/440/1800

NEW DIESEL GENERATORS

12—60 K.W. General Motors—General Electric 3/60/220

35—30 K.W. Century—International 3/60/220

9—15 K.W. General Electric—International 3/60/220

5—10 K.W. Hill 3/60/220

NEW CENTRIFUGAL PUMPS

One of the largest stocks of new Pumps of all types in the country.

Advise Capacity (GPM) Head (Ft) and electrical specification.

Also High Pressure Triplex and Steam Pumps.

THE O'BRIEN MACHINERY CO.

T.M. REGISTERED U.S. PATENT OFFICE

Bell Telephone: MARKET 4180

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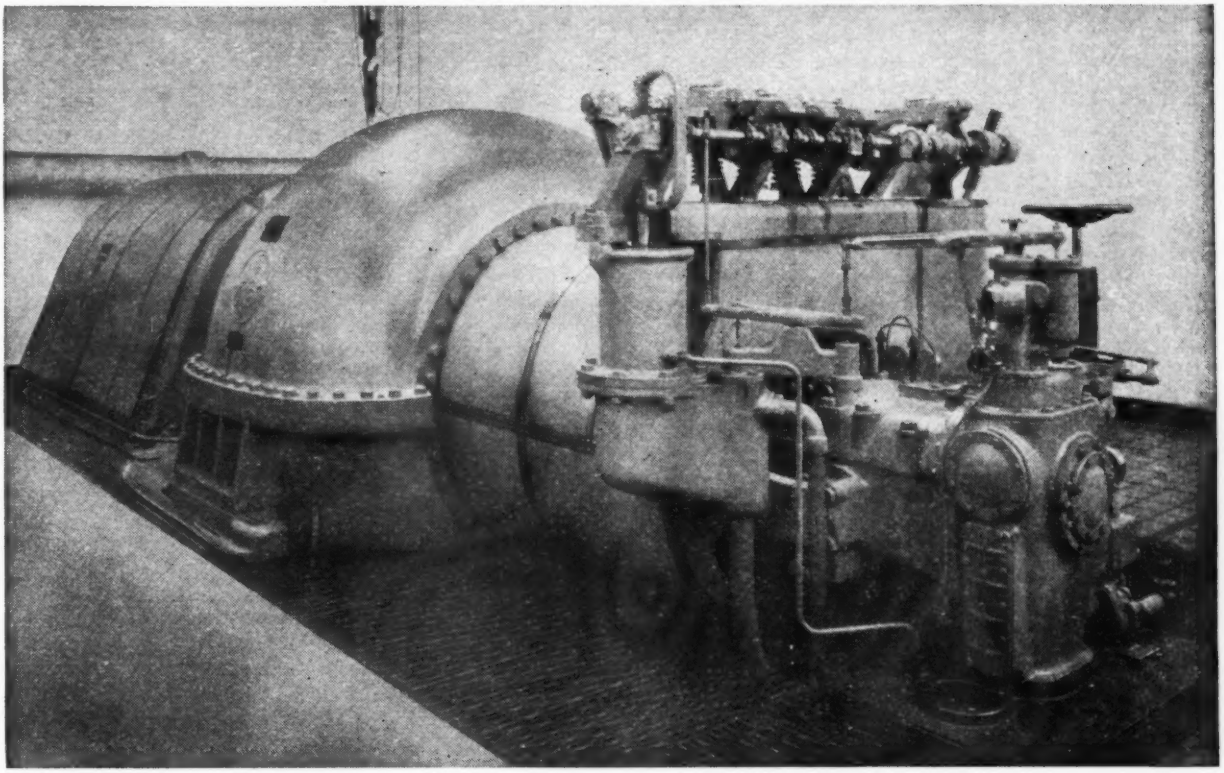
TURBINE GENERATOR UNITS AVAILABLE IMMEDIATE DELIVERY



ACTUAL VIEW

6000 KW General Electric, 13 stage, form EE, type R, 3600 RPM, 200-400 lbs. pressure direct connected to: 7500 KVA—6000 KW 80% P.F. General Electric, type ATB-2, form HT, 3 phase, 60 cycle, 2300/4000 volt, 3600 RPM alternating current generator equipped with a 9000 sq. ft., two-pass Elliott surface condenser with all condensing auxiliaries, 50 KW, 125 volt direct current steam turbine-exciter set, switchboard panels, instruments and oil circuit breaker—a complete installation. Installed new 1928.

4375 KVA G.E. condensing, 3 phase, 60 cycle, 2300 volts, 3600 RPM, 200# pressure, equipped with condenser and auxiliaries.

3125 KVA G.E. condensing, 3 phase, 60 cycle, 2300 volts, 3600 RPM, 225# pressure, 500° TT, equipped with either a surface or jet condenser, switchboard and instruments.

2500 KVA G.E. 6 stage condensing, 3 phase, 60 cycle, 2300 volts, 1800 RPM, 150-200# pressure, complete with motor driven exciter set, switchboard, C.H. Wheeler surface condenser and condensing auxiliaries.

1875 KVA G.E. condensing, 3 phase, 60 cycle, 6600 volts, 3600 RPM, 200#, 500° TT, complete with condenser.

1875 KVA Westinghouse condensing, 3 phase, 60 cycle, 480 volts, 3600 RPM, 175–200# pressure, 500° TT, complete with turbine driven exciter set, switchboard, Westinghouse jet condenser and condensing auxiliaries.

1500 KVA (2) General Electric, condensing, 200# pressure, 550 volts, 3600 RPM complete with condensers, exciters, switchboard panels and instruments.

1250 KVA Westinghouse condensing, 3 phase, 60 cycle, 2400 volts, 3600 RPM, 200# pressure, equipped with direct connected shaft exciter, condenser, switchboard and instruments.

1250 KVA Westinghouse non-condensing, 3 phase, 60 cycle, 480 volts 3600 RPM, 200-250#, 500° TT, 15 lbs. guage back pressure, complete with switchboard panel and instruments.

937 KVA, General Electric, condensing, 3 phase, 60 cycle, 2300 volt, 3600 RPM, 150# pressure equipped with condenser and auxiliaries.

625 KVA Westinghouse condensing, 3 phase, 60 cycle, 2400 volts, 3600 RPM, 200# pressure, equipped direct connected shaft exciter, condenser, switchboard and instruments.

375 KVA G.E. condensing, 3 phase 60 cycle, 2300 volts, 360 RPM, 150–200# pressure, 100° SH, complete with surface condenser.

375 KVA Allis-Chalmers — Midwest non-condensing, 3 phase, 60 cycle, 2300 volts, 3600 RPM, 150# pressure, 0–10# gauge back, complete with switchboard.

125 KVA Westinghouse non-condensing, 3 phase, 60 cycle, 240 volts, 3600 RPM, 175–200# pressure, 0–10 lbs. gauge back pressure with direct connected exciter and switchboard.

125 KVA G.E. non-condensing, 3 phase, 60 cycle, 240 volts, 3600 RPM, 125#, 10 lbs. gauge back complete with direct connected exciter.

125 KVA G.E. non-condensing, 3 phase, 60 cycle, 2300 volts, 3600 RPM, 150-200# pressure, 10 lbs. gauge back.

100 KVA Westinghouse non-condensing, 3 phase, 60 cycle, 2400 volts, 3600 RPM, 125–200# pressure, 10 lbs. gauge back.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND 14, OHIO

WIRE OR PHONE
LONG DISTANCE 422

THE PICK OF POWER EQUIPMENT

TURBINE UNITS—60 Cy.

1—22500 KW General Electric Cond.
1—15300 KVA Westinghouse Cond.
1— 7500 KVA General Electric Cond.
1— 5000 KVA General Electric Cond.
1— 3750 KVA Westinghouse Extrac.
1— 3125 KVA Westinghouse Cond.
1— 2500 KVA General Electric Cond.
1— 1563 KVA General Electric Cond.
1— 1563 KVA Westinghouse Extrac.
1— 1250 KVA General Electric Extrac.
1— 937 KVA General Electric Cond.
1— 375 KVA General Electric Cond.

D. C. TURBO UNITS

1—250 KW Westinghouse, 120/240 V.
1—125 KW General Electric, 125 V.
1— 75 KW General Electric, 125 V.
1— 50 KW Westinghouse, 125 V.

STEAM ENGINE UNITS—60 Cy.

1—625 KVA Ames Uniflow
2—480 KVA Skinner Uniflow
1—375 KVA Harrisburg Uniflow
1—325 KVA Skinner Uniflow
1—300 KVA Skinner Uniflow
1—150 KVA Ames Uniflow

D. C. STEAM ENGINE UNITS

1—500 KW Ames Uniflow 125 V.
1—400 KW Ridgway 4-valve 275 V.
1—350 KW Ridgway Uniflow 250 V.
1—300 KW Skinner Uniflow 275 V.
1—250 KW Ames Uniflow 250 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire

DIESEL ENGINE UNITS

1—1400 HP Fair.-Morse, 2300 V. 60 cy. gen.
3— 700 HP Enterprise, 2400 V. 60 cy. gen.
1— 625 HP Worthington, 240 V. 60 cy. gen.
2— 450 HP Worthington, 2300 V. 60 cy. gen.
1— 440 HP Nordberg, 250 V. DC gen.
2— 400 HP LeRoi RXISV (gasoline) eng. only
1— 375 HP McInt. & Sey., 240 V. 60 cy. gen.
1— 300 HP McInt. & Sey., 480 V. 60 cy. gen.
1— 150 HP Buckeye 400 RPM engine only
2— 125 HP Winton, 240 V. 60 cy. gen.

WATER TUBE BOILERS

4—1373 HP B. & W. 230-lb., Oil Fired
1—1302 HP Springfield 400-lb., Pulverizer
2— 760 HP Stirling 250-lb., Stokers
2— 617 HP Wickes 250-lb., Bent Tube
1— 607 HP Wickes 250-lb., Stoker
6— 600 HP B. & W. 200-lb., Stokers
2— 600 HP Springfield 200-lb., Stokers
2— 560 HP Erie City 460-lb.
2— 481 Springfield 225-lb., Pulverizer
2— 405 HP Erie City 160-lb., Stokers

SYNCHRONOUS MOTORS

1—600 HP G. E. 60 cy. 2200 V. 600 RPM
1—500 HP Al. Ch. 60 cy. 2300 V. 450 RPM
1—375 HP G. E. 60 cy. 2300 V. 1800 RPM
2—250 HP G. E. 60 cy. 2200 V. 225 RPM
1—200 HP Ideal 60 cy. 4000 V. 514 RPM
1—100 HP G. E. 60 cy. 2300 V. 240 RPM (Super)
2—100 HP E. M. 60 cy. 440 V. 1200 RPM

INDUCTION MOTORS—60 Cy.

1—1000 HP West. slip ring 2200 V. 360 RPM
1— 300 HP West. slip ring 440 V. 1200 RPM
1— 200 HP Burke sq. cage 440 V. 575 RPM
2— 100 HP G. E. sq. cage 440 V. 720 RPM
2— 100 HP West. sq. cage 220/440 V. 1800 RPM

MOTOR GEN. SETS—60 Cy.

1—1000 KW General Electric 600 V. DC
1— 300 KW Westinghouse 600 V. DC
1— 150 KW General Electric 125 V. DC
1— 100 KW Westinghouse 125 V. DC
1— 100 KW Burke 250 V. DC
1— 75 KW General Electric 125 V. DC
1— 50 KW Westinghouse 250 V. DC

ROTARIES—60 Cy.

2—2600 KW General Electric 300 V.
1—2000 KW General Electric 600 V.
2—1750 KW General Electric 250 V.
1—1500 KW Westinghouse 250 V.
2—1000 KW Westinghouse 250 V.
1— 500 KW General Electric 250 V.

FREQUENCY CHANGERS

1—12500 KW G. E. 60/25 cy. 300 RPM
2— 3125 KVA West. 25/62½ cy. 750 RPM
1— 1875 KVA G.E. 25/60 cy. 300 RPM
1— 1500 KW West. 25/60 cy. 300 RPM
1— 1000 KVA Al. Ch. 25/62½ cy. 375 RPM

TRANSFORMERS—1 Ph. 60 Cy.

4— 6667 KVA G.E. 79660/138,000-34500 V.
3— 3333 KVA Moloney 66000/33000-13200 V.
1— 1500 KVA Pitts. 66000-33000 V. 3 ph.
3— 750 KVA Pitts 66000-33000 V.
3— 100 KVA G.E. 66000-6900/11000 V.
3— 1000 KVA G.E. 44000/22000-480 V.
1— 7500 KVA West. 33000-13800 V. 3 ph.
3— 200 KVA G.E. 33000-2300/4000Y V.
3— 150 KVA G.E. 33000-2300 V.
40— 50 KVA G.E. 33000-2400 V. New
50— 25 KVA G.E. 33000-2400 V. New
2—10000 KVA West. 26400-4560 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
3— 200 KVA G.E. 22000-230/460 V.
1—10000 KVA West. 13200-456 V. 3 ph.
1— 3000 KVA G.E. 13200-480 V. 3 ph.
3— 1667 KVA Pitts. 13200-2300 V.
4— 1250 KVA Pitts. 13500-230/460 V.
3— 200 KVA G.E. 13200-480 V. Pyranol
3— 100 KVA West. 13200-2300 V.
1— 2000 KVA G.E. 6600-2300, 3-P. Master Sub.
3— 150 KVA G.E. 4150-220 V. 3 ph.
2— 1500 KVA Al. Ch. 2400-480 V. 3 ph.
3— 333 KVA G.E. 2400/4150-230/460 V.
3— 250 KVA Al. Ch. 2300-230/460 V.

OIL CIRCUIT BREAKERS

3— 400 A. 37 KV Condit F040A	Outdoor
2—1000 A. 30 KV Kelman CB76	"
1— 400 A. 25 KV G.E. FK0136	"
2— 600 A. 15 KV G.E. FK037	"
1— 600 A. 15 KV West. 0-221	"
2— 400 A. 15 KV G.E. FHK0136	"
3— 400 A. 7.5 KV G.E. FK0227	"
2—1200 A. 7.5 KV G.E. FK132B	"

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 Church Street New York City 7, New York

TURBO GENERATORS

750 KW., 3 ph., 60 cy., 480V. 3600 Allis Chalmers to a Moore extraction type Turbine with board.

500 KW., 3 ph., 60 cy., 480V. Westgh. non cond. Turbo Generator with board.

937 KVA., 3 ph., 60 cy., 2300V. Gen. Elec. cond. Turbo Generator.

ROTARY CONVERTER

1—1500 KW., 250 V. Westgh. complete.

1—156 KVA., 3 ph., 60 cy., 240 volt Gen. Elec. to an 8 cylinder Buffalo engine only 5 years old, little used.

The above are just a few of the thousands of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, Transformers, Circuit Breakers, etc. Please send us your inquiries.

What have you for sale?

KEYSTONE

Power Plant Equipment Company

8403 Hegermen St., Phila. 36, Penna.

POWER PLANT EQUIPMENT

Special Offerings

TURBO-GENERATORS

1—3000 KW. 2300 V. Cond.
1—2500 KW. 2300 V. Cond
1—1250 KW. 2300 V. Cond.
1— 250 KW. 240 V. N. C.
1—2000 KW. 600 V. Cond.
1—1500 KW. 2300 V. Cond.
1— 750 KW. 2300 V. Cond.
1— 500 KW. 440 V. N. C.
1— 500 KW. 125 V. D.C.
1— 375 KW. 440 V. Cond.
1— 120 KW. 440 V. N. C.

ENGINE GENERATORS

1—540 KW. Uniflow 480 V.
1—150 KW. 480 V.
1—600 H.P. Uniflow Eng.
1—168 KW. 550 V.
2—280 KW. 440 V.
1—600 KW. 2300 V.

TURBINES ONLY

1—375 H.P. with gears
1—210 H.P. Terry 250#
1—100 H.P. G.E. with gears

BOILERS

1— 990 H.P. 200# Coal
1— 825 H.P. 175# Coal
1—1390 H.P. 400# Coal
2— 480 H.P. 225# Coal
1— 360 H.P. 190# Coal
2— 300 H.P. 250# Coal
1— 260 H.P. 200# Coal
2— 175 H.P. 200# Coal

MOTOR

1—1250 H.P. G.E. Syn. Engine Type 2300 V.

AIR COMPRESSORS

1—6700 C.F. 22# Turbine Driven
1—1600 C.F. 50# Steam
1—3000 C.F. 125# Motor
1—1570 C.F. 100# Motor
1—1247 C.F. 55# Motor
1—1214 C.F. 100# Motor
1— 600 C.F. 350# Steam

AIR TANKS

3—10' x 36" Mass. Std.

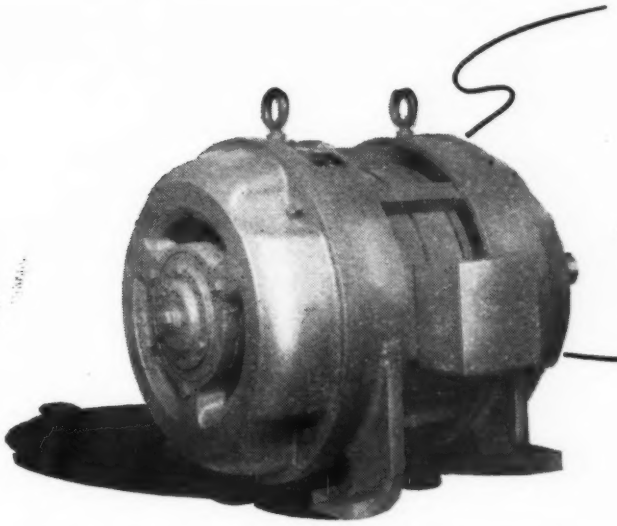
CONDENSERS

1—3100 Sq. Ft. Worth.
1—1485 Sq. Ft. Wheeler.

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Mchy. Bldg., Boston, Mass.

The Buyer Must Be Satisfied—Always



POWER EQUIPMENT from stock

MOTORS • TRANSFORMERS • STARTING COMPENSATORS • OIL CIRCUIT BREAKERS • GENERATOR SETS

10—50 HP Reliance Motors, type AA-445, 2300 V. 60 cy. 3 ph. 1800 rpm. All rebuilt

10—50 HP Reliance Motors, AA-445, 550 V. 60 cy., 3 ph. 1800 rpm. All rebuilt

1—60 HP CR. Wheeler, TEFCBB, 2300, 60, 3, 1800 rpm. All rebuilt

2—60 HP CR. Wheeler TEFCBB, 2300, 60, 3, 1200 rpm. rebuilt

1—60 HP CR, Wheeler TEFCBB, 440, 60, 3, 1200 rpm. Rebuilt

Send Us your Surplus Listings, WE BUY FOR CASH.

MOTORS—SQ. CAGE

3 Phase—60 Cycle—220/440 Volt

100 Motors up to 15 HP—all makes and types and speeds.

Qu.	H.P.	Make	Type	Speed
1	15	West.	CS	1800
1	15	G.E.	KT	1200
1	15	G.E.	KT	900
1	20	G.E.	KT 302	1800
1	20	G.E.	KT 312	1200
1	25	G.E.	KT 30N	1800
2	25	West.	CS	1200
1	25	G.E.	KT 322	900
2	25	Line.	Nema	600
1	30	G.E.	KT 312	1800
1	30	West.	CS	1800
2	30	West.	CS	1200
1	30	G.E.	KT 336	720
1	40	G.E.	KT 323	1800
1	40	G.E.	KT 336	900
1	50	G.E.	KT 327	1800
1	50	West.	CS	900
1	50	G.E.	KT	720
1	60	G.E.	KT 333	1800
1	75	G.E.	KT 337	1800
1	75	G.E.	IK	720
1	100	G.E.	IK	900
1	100	G.E.	KT	514
1	125	Cr. Wh.	SC	900
1	150	West.	CS	1800

Also larger Units avilable. Mail your inquiries. We also carry in stock a large number of 2300 v. motors. All types, makes and speeds. Mail us your inquiries on these machines.

MOTORS—SQ. CAGE

3 Phase—25 Cycle—220/440 Volt

50 Motors in stock up to 15 HP. Send details, we will quote.

Qu.	H.P.	Make	Type	RPM
4	20	West.	CS	750
1	25	West.	CS	1500
1	25	G.E.	KT	750
1	30	G.E.	KT	750
1	40	Al.-Chal.	AR	1500
1	40	West.	CS	750
1	75	G.E.	IK	750
1	100	G.E.	IK	750
2	150	G.E.	IK	750

Also in stock many 2300 V. motors—also all types of 25 cycle Slip-ring motors, all types and makes.

MOTORS—SLIP RING

60 Cycle—3 Phase—220/440 Volt

25 Motors—In stock up to 10 H.P.—All Speeds and types.

Qu.	H.P.	Make	Type	Speed
1	15	G.E.	MT	1800
1	15	G.E.	MT 312	1200
1	15	G.E.	MT 312	900
1	20	G.E.	MT 322	1200
1	20	G.E.	MT 326	900
1	25	G.E.	MT 326	1200
1	40	G.E.	MT 332	1200
1	40	G.E.	MT 336	900
1	50	West.	CW	1200
1	50	Al.-Chal.	ANY	900
1	50	G.E.	MT 342	900
1	60	G.E.	MT 346	900
1	75	G.E.	MT 356	900
2	75	Al.-Chal.	ANY	900
1	75	West.	CW	900
1	75	G.E.	IM	720
1	100	G.E.	MT 356	900
1	100	G.E.	IM	720
1	150	West.	HF	600
1	150	West.	CW	600
1	200	G.E.	IM	514

Also larger Units available.

60 Cycle—3 Phase—2300 Volts

Qu.	H.P.	Make	Type	Speed
1	75	G.E.	MT 300	900
1	100	G.E.	IM	600
1	150	G.E.	IM	600
1	200	G.E.	IM	720
1	200	G.E.	IM	600
1	300	G.E.	IM	600

All types of Slip Ring controls in stock.

A.C.—60 CYCLE—3 PHASE GENERATORS

KVA	Make	Type	Volts	RPM
25	Diehl	9	220	1800
50	G.E.	ATB-P	240	1200
75	G.E.	ATB	2300	900
100	G.E.	ATB-PB	2300	900
150	G.E.	ATB-P	240	900
180	G.E.	ATB-PB	240	600

D.C. VARIABLE SPD. MOTORS

230 Volts

25 Motors up to 10 H.P. Any speed range

Qu.	H.P.	Make	Type	Speed
1	25	G.E.	RF 13	400/1200
1	25	West.	SK	300/1200
1	25	Rel.	131 T	800/1600
1	25	Rel.	155 T	500/1500
1	35	West.	SK	500/1500
1	50	G.E.	RF 14	500/1500
1	100	G.E.	MPC 6	300/600

D.C.—230 V.—MOTORS

50 Motors up to 10 H.P., all speeds and makes. Send inquiries.

Qu.	H.P.	Make	Type	Speed
1	15	G.E.	CD	1800
1	15	G.E.	RC	1200
2	15	West.	SK	1200
1	15	West.	SK	900
1	20	West.	SK	1200
1	20	West.	SK	900
1	25	West.	SK	1800
2	25	West.	SK	1200
2	25	G.E.	RC	900
1	40	West.	SK	1200
1	60	West.	SK	1800
1	75	West.	SK	1800
1	100	G.E.	CD	1200
1	150	West.	SK	1800

D.C.—115 V.—MOTORS

Qu.	H.P.	Make	Type	Speed
1	10	G.E.	RC	1200
1	10	G.E.	RC	900
1	15	West.	SK	1200
1	15	West.	SK	900

Above partial listing, many others available.

1—75 HP CR, Wheeler TEFCBB, 2300, 60, 3, 1200 rpm. Rebuilt

1—75 HP CR. Wheeler TEFCBB, 440, 60, 3, 1200 rpm. Rebuilt

Also in Stock, Starting Equipment

20—50/75 HP GE CR7006-T3F Magnetic Switch. 2200 V, 60 cy., 3 phase, Sec. V, 220 V. Cat. No. 4981306G4. With current transf. & temperature Relay CR2824-2-D

We Carry in Stock Brand New Motors

POWER Equipment Company

P. O. Box 534 Tel. Main 569

Rochester 2, N. Y.

CHICAGO'S LARGEST STOCK GUARANTEED EQUIPMENT

MOTOR—GENERATOR SETS

KW	Make	DC Volts	AC Volts
800	Wtg.	275	Syn. 3/60/13200
750	Elliott	275	Syn. 3/60/440
500	G.E.	600	Syn. 3/60/2300/4000
400	Wtg.	275	Syn. 3/60/440
400	G.E.	250	Syn. 3/60/2300
300	G.E.	250	Syn. 3/60/480
225	Ideal	115	Syn. 3/60/2200
200	Elliott	115	Syn. 3/60/480
200	Wtg.	250	Syn. 3/60/440
100	G.E. 3 wire		Syn. 3/60/480
75	G.E.	125	Ind. 3/25/220
75	G.E.	125	Ind. 3/25/440
90	Wtg.	110	75 KVA 3/60/2300
60	Al. Ch.	110	Ind. 3/60/2300
50	G.E.	115	Ind. 3/60/440
35	G.E.	250	Ind. 3/60/220
17½	G.E.	125	Ind. 3/60/2200
7½	Cr. Wh.	125	balancer set
7½	G.E.	60	Ind. 3/60/440
3	Hertner	65	Ind. 3/60/220
3	Hertner	45	Ind. 3/60/220
3	Lincoln	110	Ind. 3/60/220
2.5	Nwstn.	110	Ind. 1/60/220

SLIPRING MOTORS

3 phase, 60 cycle

HP	Make	Type	Volts	Speed
800	Wtg.	CW	6600	507
600	G.E.	IM	2200	1200
600	Al. Ch.	ANY	2200	1180
600	Wtg.	CW	2300	343
300	G.E.	IM	2200	514
150	Wtg.	CW	2200	1200
100	Wtg. vert.	CW	2200	1160
100	Ideal	AV	2200/440	720
100	Westg.	HF	440	230
75	Nwstn.	HW	220	1740
50	Wtg.	HF	440	860
60	Al. Ch.	ARY	220	690
50	G.E.	I-M	220	850
50	Al. Ch.	ARY	220	690
50	Wtg.	CW	440	570
50	G.E.	MT	2200	600
40	Cr. Wh.	20Q	220	1160
40	Wagner	BR	440	1750
40	Al. Ch.	ARY	220	1160
30	G.E.	MT	440	1150
30	Wtg.	CW	220	865
25	G.E.	I-M	220	855
25	G.E.	IM	220	1140
25	G.E.	IM	220	855
15	Wtg.	C.W.-461C	220	1750

FREQUENCY CHANGER

1—1400 HP General Electric type ATI-24-1250M-300, form C, 3 ph, 60 cy, 460 volt, 300 RPM, 1570 amps, 1250 KVA, 0.9 P.F. 50° synchronous motor with amort. wdg.; dir/conn. to 1000 KW General Electric type ATI-10-1250M-300, 3 ph, 25 cy, 460 volts, 300 RPM, 1570 amps, 1250 KVA, 0.8 P.F. 50° A.C. generator with amort. wdg., with 33 KW G.E. 125 volt direct connected exciter. (This is a three brg. unit suitable for operation from either end.)

SQUIRREL CAGE MOTORS

HP	Make	Type	Volts	Speed
350	G.E.	KT563	440	1765
150	Wtg.	CS	2200	720
200	Wtg.	CS	440	580
200	G.E.	I-K	440	580
150	Al. Ch.		440	570
150	G.E.	I-K	440	1730
150	G.E.	I-K	440	575
150	G.E.	I-K	2250	580
125	G.E.	I-K	220	1165
100	Wtg.	CS	440	1160
100	Wtg.	CS	2200	870
100	G.E.	KF	440	900
75	G.E.	KT	2200	1800
75	Al. Ch.	ARY	2200	1800
75	Wtg.	CS	2200	800
60	Wtg.	CS vert.	2200	1750
60	G.E.	KT333	220	1740
60	G.E.	K504	NEW	1200
60	G.E.	KT346	440	865
60	G.E.	KT	440	865
50	G.E.	KT333	220	1740
50	G.E.	KT	440	1165
50	G.E.	KT	2200	900
50	Wtg.	CS	440	699
50	Al. Ch.		440	570
50	Cr. Wh.		220	1200
40	G.E.	KF44Y	2200	1745
		gear type to 581 RPM		
40	G.E.	K440	NEW	1200
40	Cr. Wh.		220	1800
40	G.E.	KT327	220	1745
40	Al. Ch.		440	850
40	G.E.	KT	2200	900

SQUIRREL CAGE MOTORS

HP	Make	Type	Volts	Speed
30	Al. Ch.	ARZ	440	695
		tot. enc. fan cld.		
35	Wtg.	CS	2200	1170
35	G.E.	1-K	440	680
30	G.E.	KF-405	440	1800
35	Al. Ch.		440	480
30	G.E.	KT	220	600
30	Al. Ch.	AR	440	685
35	G.E.	KT	220	900
35	G.E.	IK	440	1200
25	Ideal	A-A-8015	220	1740
25	G.E.	KT	440	600
25	G.E.	K-364	NEW	1800
25	Howell	SC	220	600
25	G.E.	KT	220	1125
20	Cr. Wh.	1170	440	1140
20	Wagner	195BP	220	1200
20	G.E.	TEFC	NEW	1800
20	G.E.	K864	NEW	1800
20	G.E.	KT326	220	870
20	G.E.	KF	TEFC	1800
20	Al. Ch.	AN	220	850
20	Westg.	CCL	220	850
20	Reliance	60AA	440	1750
20	Westg.	CS	440	1200
20	Wagner	15VRN	440	1200
15/5	G.E.	KF404	TECF	1775/560
15	L. Allis	OX326X	440	1760
15	G.E.	I-K	440	1200
15	Al. Ch.	AR216	440	900
15	Comm.	P404	220	900
15	G.E.	I-L	220	720
10	F.M.	UJL	vert.	1750
10	Lincoln	I-K	440	1200
7½	F. M. vert.	UH1	220/440	3470
7½	Westg.	CS324	220/440	1150
7½	Comm.	P324	220/440	1150
5	G.E.	K254	NEW	1800
5	U. S.	358	220	1200
3	G.E.	KT713	220	3460
3	Westg.	CS234	220	1140
3	Willey	Intm.d.	440	1050
3	C. Wh.	TEFC	220/440	1720

TRANSFORMERS

Single phase, 60 cycles

Qu.	kva	Make	Type	Voltage
3	1000		SC	13200/480
3	833		SC	6600/2300
2	100	G.E.	H	1200/220/440
1	100	Wtg.	SK	6900/115/230
1	100	Wtg.	AVR	480/240
		weatherproof enclosure		

TRANSFORMERS

Qu.	Kva	Make	Type	Voltage
1	100	Wtg.	SK	2300/110/220
3	75	Wtg.	S	3810/244/122
2	75	Wtg.	S	2200/110/220
1	75	G.E.	H	2300/230/460
8	50	G.E.	H	2200/220/440
1	50	Pitts.		13200/6600
3	50	Moloney	HE	2300/230/460
3	50	Pitts.		2200/110/220
1	50	G.E.	H	12000/110/220/440
1	40	Packard	A	2200/110/220
1	40	G.E.	H	2300/230/460
1	40	Pitts.		2200/110/220
1	37½	G.E.	H	2300/230/460
2	37½	G.E.	H	12000/230/440
1	37½	G.E.	H	26400/2300
1	30	G.E.	H	2300/110/220
1	30	Moloney	HE	13200/230
1	25	G.E.	H	2300/2300
1	20	Kuhlman		2300/115/230
1	20	Moloney		1100/2200/110/220
4	20	G.E.		1100/2200/110/220
1	20	G.E.	H	2200/220/440
1	15	G.E.	H	6900/2300
1	15	G.E.	H	2400/120/240
1	15	G.E.	A	1050/2200/288
1	15	Pitts.	25 cy.	2200/110/230
3	15	G.E.	H	13000/2300
1	15	G.E.	H	11000/2200
1	15	G.E	H	440/110/220
3	15	Albertson		2300/115/230
1	15	Westg.	S	2300/115/230
2	10	G.E.	A	2200/110/220
1	10	Moloney	HE	2300/110/220
1	10	Stanley	BO	2200/110/220
1	10	W.E.	T	2200/110/220
1	10	Packard		2200/110/220

STEAM ENGINES

400 KVA Filer-Stowell 15x28x36 cross compound Corliss engine, with Crocker Wheeler 3 phase 60 cycle, 220 or 440 volts AC generator.

676 KVA G.E. A.C. generator, 3 phase, 60 cycle, 480 volt, direct-connected to Ames uniflow horizontal steam engine.

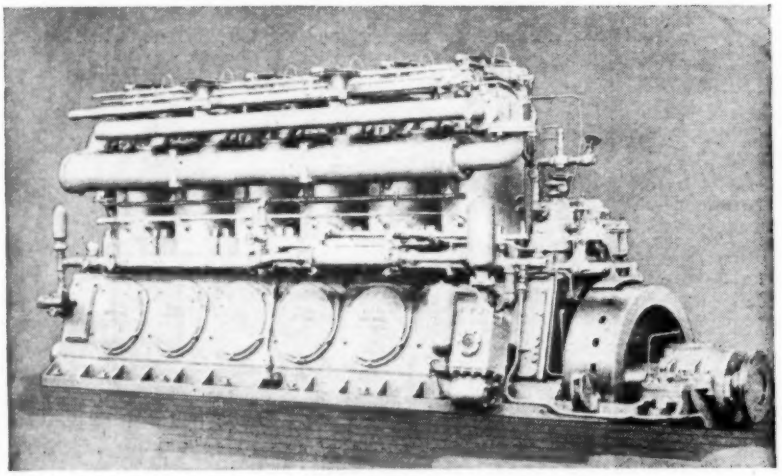
This is a partial listing, only have NEW from ¼ to 75 hp right in stock.

WE ARE ALWAYS IN THE MARKET FOR ALL TYPES OF GOOD MODERN ELECTRIC MOTORS, MOTOR-GENERATOR SETS GENERATORS, TRANSFORMERS, AND OTHER ELECTRICAL EQUIPMENT. SEND US YOUR LISTS FOR BEST CASH OFFERS.

CHICAGO ELECTRIC CO. 1320 W. CERMAK RD. CANAL 2900 CHICAGO 8, ILL.

NEW DIESEL ENGINES

Immediate Delivery



400-HP Atlas Imperial Diesel Engine

WE OWN and CAN SHIP FROM STOCK

400-HP, 320-HP, 120-HP Atlas Imperial Diesel Engines
400-HP, and 525-HP. @ 400 RPM, Cooper Bessemer Diesel Engines

Also Any Other Size or Capacity Diesel Engine Desired

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WILMS, WEAVER & COMPANY, DETROIT, MICH.

4045 Penobscot Building—Telephone 5-1340-1

WAGNER
"Certified Rebuilt" ELECTRICAL APPARATUS

M-G SETS

300 KW Gen. Elec. type MPC gen. DC 170 volts 1760 amp. coupled to 450 HP G.E. MPC motor DC 250 V. 1150 RPM (can furnish A.C. drive).
100 KW Gen. Elec. 3 brg. unit, type RC gen. DC 125 v. coupled to 150 HP sq. cage 1-K motor 3-60-2200/4000 V.—1200 RPM.
50 KW Cr. Wheeler type CC generator DC 125 V. coupled to 80 HP C-W motor sq. cage 3-60-220/440 V. 1800 RPM.
40 KW Martin rotary converter, input 3/60/220 v., output DC 230 v., with panel.
35 KW Gen. Elec. DLC gen. DC 250 V. to 50 HP AC motor 3-60-220/440 V.
30 KW Gen. Elec. CD 103 gen. DC 60 v. 500 amp. coupled to 45 HP G.E. KT 532 motor 3-60-220/440 v. 1160 RPM. late style 3 brg. unit.

Others available—special units built to order.

D. C. MOTORS

H.P.	Mfg.	Type	Volts	Speed
450	Gen. Elec.	MPC	230	1150
75	Whse.	S13	125	475
75	Gen. Elec.	DLC	230	400
60	Diehl dynamom	R10	250	500/2000
50	G.E. Sprague	LC	250	700
50	Whse.	SA	230	450/1350
40	Gen. Elec.	DLC	230	750
40	Roth	S	115	850
40/50	Reliance (3) b.b.	310T	230	600/1800
40	Whse.	SK	230	1700
35	Whse.	SK140	230	675
30	Allis Ch.	E100	230	1800
30	Sprague	dynamom	250	800/2000
25	Gen. Elec.	DLC	115	750
25	Roth	elevator	230	725
25	Whse. enclosed	SK	230	600
25	Whse.	SK	230	950
25	Sprague dyna.	LC	115	700/1500
25	Gen. Elec.	RC32	230	800
22	Whse. crane	K-6	230	1050
20	Imperial int. dty	D37	230	1200
20	Gen. Elec.	RF12	230	400/1200
20	Gen. Elec.	DLC	230	500/1500

SQUIRREL CAGE MOTORS
3 Phase—60 Cycles—220 or 440 Volts

Qua.	H.P.	Mfr.	Type	Speed
1	200	F.M. b.b. 2200 v.	H	1800
1	150	Gen. Elec.	I-K	900
2	125	Whse. 2200 v.	CS	1800
1	100	F. Morse b.b.	H	1800
1	75	Allis Ch.	AN	720
2	60	Gen. Elec.	I-K	3600
1	60	Allis Ch.	B	600
1	60	Gen. Elec.	I-K	720
1	50	Gen. Elec.	I-K	600
1	50	Gen. Elec. vertical	KT	1200
2	50	Gen. Elec.	I-K	900
2	40	Allis Ch.	AN	1200
1	40	Gen. Elec.	KT332	1200
1	40	L. Allis TEFC b.b.	JX-445	1200
2	40	Gen. Elec.	KT-336	900
2	30	Diehl New b.b.	IN-365	1800
2	30	Whse. b.b.	C8444	1200
1	30	G.E. TEFC b.b.	KF444	1200
2	30	Allis Ch.	AN	1200
3	30	Allis Ch.	AN	900
1	30	Howell	SC	720
1	25	F. Morse b.b.	Q64	3600
1	25	Whse. New	C8365	1800
1	25	Gen. Elec.	KT322	1200
2	25	Allis Ch.	AN	900
2	25	Allis Ch.	AN	1200
2	20	Diehl New b.b.	IN364	1800
1	20	Whse. b.b.	CS	1200
4	20	Allis Ch.	AN	900
2	20	Gen. Elec.	I-K	1200
1	20	Ideal	AA	1200

25 CYCLE MOTORS

H.P.	Mfg.	Type	Speed
450	Whse. 2200 v.	CW sl. rg.	750
150	Whse.	HD sl. rg.	500
150	Gen. Elec. 2200 v.	MT359 sl. rg.	1500
100	Whse.	CCL sq. cg.	500
100	Gen. Elec.	I-K sq. cg.	500
50	Allis Ch.	ANY sl. rg.	1500

SYNCHRONOUS MOTORS

H.P.	Mfg.	Type	Volts	Speed
750	Allis Ch.		220/440	1200
350	Gen. Elec. 3 brg.	ATB	220/440	600
300	Whse.	ped.	220/440	900
290	Gen. Elec.	ATI	220/440	600
250	Gen. Elec.	ATI	220/440	514
250	Gen. Elec. 1 brg.	ATI	220/440	600
150	Gen. Elec.	ATI	220/440	900
75	Ideal	SMS	220/440	1200
40	Gen. Elec. 8 PF	TS	220/440	900

CENTRIFUGAL PUMPS
8" Alberger, 2000 gpm @ 80 ft.
6" Platt, 1000 gpm @ 230 ft.
8" Worthington, 2000 gpm @ 200 ft.

SLIP RING MOTORS
3 Phase—60 Cycles—220 or 440 Volts

Qua.	H.P.	Mfg.	Type	Speed
1	350	Whse. 2200 v.	CW	720
1	300	Burke	EMV	225
1	300	Whse.	HF	400
1	300	Gen. Elec.	I-P	720
1	250	Gen. Elec.	I-M	600
1	200	Gen. Elec.	I-M	600
1	150	Gen. Elec. 2200 v.	MT	1200
1	100	Gen. Elec. 2200 v.	I-E13A	1800
1	100	Gen. Elec.	I-M	900
1	75	Gen. Elec.	I-M	514
1	75	Gen. Elec.	MT537	1800
1	75	Gen. Elec. 2200 v.	I-E13	1800
1	65	P. & H. b.b. Int.	CA16	900
1	60	Whse. 2200 v.	CW657	1800
1	50	Gen. Elec.	MT536	1200
1	60	Gen. Elec.	MT536	1200
1	50	Gen. Elec.	I-M	600
1	40	Gen. Elec. 2 ph.	MQ536	900
1	40	North'n	HW35A	1200
2	40	Gen. Elec.	MT532	1200
1	40	Fair Morse b.b.	HV	1200
1	40	Whse.	CW	900
2	40	Gen. Elec.	M546	514
2	40	Allis Ch.	ANY	450
1	40	G.E. 550 v.	MT536	900
1	35	Fair. Morse b.b.	HV	1800

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	Gen. Elec. 1 brg.	MPC	125/170	1150
150	Gen. Elec.	MP	250	600
75	Whse.	S	125	600
60	Gen. Elec.	DLC	250	450
50	Cr. Wheeler	CC	125	1800
50	J&L	upd.	250	750
35	Gen. Elec.	DLC	250	900
30	Gen. Elec.	CD113	250/125	900
30	Lincoln b.b. 600 amp.		50	1200
25	Gen. Elec.	DLC	125	900
25	Gen. Elec.	RC	250	900
20	Allis Ch. (2)		125	475
16	Cr. Wheeler	CCD	125	415

ALSO IN STOCK . . . OIL SWITCHES BLOWER & FANS . . . SPEED REDUCERS . . . 500 NEW MOTORS

60 CYCLE A.C. GENERATORS

KVA	Mfr.	Type	Volts	Speed
500	Gen. Elec. 3 brg.	ATB	2300	450
300	Gen. Elec. 3 brg.	ATB	240/480	600
300	Whse.	ped.	240/480	900
300	Elec. Machy. 3 brg.		240/480	720
250	Gen. Elec. 1 brg.	ATB	240/480	600
150	Gen. Elec.	ATB	240/480	900
150	Allis Ch.		2300	900
150	Allis Ch. 25 cycle		240/480	500
100	Cr. Wheeler	ped.	240/480	600
50	Cr. Wheeler		240/480	1200

ARTHUR WAGNER COMPANY
1436-38 W. RANDOLPH STREET — CHICAGO 7, ILL. — MONroe 7409

SYNCH. CONVERTERS

500 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
150 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

300 KW G.E. SYN. 600 V. 2300/4000 A.C. 1200 RPM
300 KW WEST. SYN. 250 V. 4000/6600 A.C. 900 RPM
150 KW WEST. SYN. 600 V. 2300/4000 AC. 1200 RPM

Each unit listed above is owned by us and is available now for immediate purchase

WALLACE E. KIRK CO.
Incorporated
502 Grant Building, Pittsburgh, Pa.

TRANSFORMERS
New or used. All types and sizes. Air and oil cooled. Phase changers a specialty.
ATLANTIC TRANSFORMER CO.
Transformer Specialists
5143 N. 2nd St. Phila., Pa.

ELECTRICAL EQUIPMENT
REBUILT and GUARANTEED—PROMPT SHIPMENT
MOTORS-GENERATORS-MG SETS-TRANSFORMERS-CONTROLS

SPECIAL OFFERING
10—G. E. VARIABLE VOLTAGE DRIVES
COMPLETE WITH CONTROLS

EACH MOTOR GENERATOR CONSISTS OF:
1—Type K, Frame 444, 60 HP, 220/440 V., 3 ph., 60 cy., 1750 RPM Motor.
1—Type CD, Frame 95, 40 KW, 250 V. Generator.
2—Type B, Frame 284, 5 KW, 300 V. Auxiliary Generators.
1—Type B, Frame 225, 2 KW, 250 V. Exciter.

MOTORS:
Type CD, Frame 1441, Ball Bearing, 40 HP, 230 V., 250/1500 RPM By Field Control. Below 250 RPM Speed Control By Armature Voltage.
Type B, Frame 284, 5 HP, 1 Hr. 55°, 300 V., 1750 RPM, Variable Speed By Armature and Field Control.

ENCLOSED CONTROL PROVIDES:
Across-the-Line Magnetic Switch for 60 HP Motor. Full Magnetic Control for 40 HP DC Motor Providing Run, Stop, Jog Forward, Jog Reverse, Increase Speed, Decrease Speed, Full Field, Overload, Field Accelerating and Decelerating, Combination Motor and Generator Motor Operated Field Rheostats, Preset Speed Acceleration. Full Magnetic Reversing Control for 5 HP Motors.

Send Us A List of Your Requirements. We Buy Your Surplus

ELECTRIC GENERATOR & MOTOR CO.
4521 HAMILTON AVE. CLEVELAND, 14, OHIO
Phone: ENdicott 5656 Established 1900

MOTORS • GENERATORS • TRANSFORMERS

MOTORS
3 phase, 25 cycle, 220/440 Volts

HP	Make	Type	Frame	RPM
1	Gen. Elect.	K	224	1450
1	Westinghouse	CS	224	1425
1	Robbins-Myers	H	Ball Bearing	1425
1	Gen. Elect.	KT	926	1345
1½	Louis Allis	FS	Ball Bearing	1430
2	Gen. Elect	KT	731	750
2	Brown & Brockmyer		Enclosed	1450
2	Gen. Elect.	KT	934	1450
2	Gen. Elect.	KT	140	1450
2(3)	Reliance	Enclosed	Ball Bearing	750
2(5)	Westinghouse	T.E.F.C.B.B.	284	500
2(3)	Reliance	Ball Bearing	15AA	750
3	Westinghouse	CS	284	750
3	Allis Chalmers			710
3	Gen. Elect.	KT	180	710
3	Westinghouse	CS	354A	715
3	Wagner	LBP		1420
3(5)	Gen. Elect.	KT	944	1500
3(2)	Cr. Wheeler	T.E.F.C.B.B.	284	750
3	Cr. Wheeler	SC		1500
3	Reliance	Ball Bearing		750
5	Gen. Elect.	KT	180	1500
5	Gen. Elect.	K	284	1450
5	Gen. Elect.	KT	181	750
5	Reliance	Ball Bearing	44AA	750
7½	Lincoln	B. B.	D111	1500
7½	Howell	B. B. R.	326	1500
7½	Gen. Elect.	KF		1450
7½(2)	Gen. Elect.	KT	181	1450
7½	Century	ARS		1450
7½	Wagner			750
10(7)	Wagner	19TBM		710
10	Westinghouse	CS		710
10	Reliance			750
10(2)	Gen. Elect.	KT	312	750
10(5)	Gen. Elect.	KT	512	750
10(3)	Westinghouse	Enclosed	Gear Head	1500/378
15	Gen. Elect	KT	327	750
15	Westinghouse	MS		750
15(3)	Westinghouse	CCL		750
15	Westinghouse	CCL		1500
15	Master	Enclosed	Gear Head	1500/416
20	Westinghouse	CS		730
20(3)	Westinghouse	CCL		750
20	Wagner	BP22T		750
25	Gen. Elect.	I	Form K	750
30	Burke			750
30	Gen. Elect.	I	Form K	750
30	Wagner			750
40	Wagner	22TLBP		1500
40	Gen. Elect.	KT	347	750
50	Gen. Elect.	I	Form K	750
75(4)	Gen. Elect.	I	Form K	500
75(2)	Gen. Elect.	KT	557	750
75	Westinghouse	CS		750
100	Westinghouse	CCL		500
150	Gen. Elect.	I	Form K	375
150	Gen. Elect.	KT	568	375
150	Gen. Elect.	KT	557Y (2200 v.)	1470
200	Gen. Elect.	I	Form K	500
225	Elect. Mach.	Synch.	(2200 v.)	500

TRANSFORMERS

3— 75 KVA Niagara. New. OISC 60/1/2400/120/240
6—100 KVA Niagara. New. OISC 60/1/2400/120/240.
3—150 KVA Westinghouse OISC 25/1/2300/460.
3—200 KVA Westingnouse OISC 25/1/2300/460.
3—500 KVA Pittsburgh OISC 25/1/2300/230/460.

MOTORS
3 phase, 60 cycle, 220/440 Volts

HP	Make	Type	RPM	Serial No.
15	Westinghouse	CS	1200	1883285
15	Westinghouse	MS	1200	9445931
20	Westinghouse	CS	1200	2160500
20	Westinghouse	MS	1200	1050826
20	Westinghouse	CS	1800	1863526
20	Westinghouse	CS	1800	2695044
25	Westinghouse	MS	1800	1562026
25	Westinghouse	MS	1800	1334763
25	Westinghouse	CS	1200	2286768
25	Westinghouse	MS	1200	1197673
25	Wagner	BP	1200	126906
30	Westinghouse	MS	1200	1197674
30	Fairbanks-Morse	V-H-10D	1800	43476
40	Westinghouse	CS	900	1896969
40	General Electric	I-K	1800	73318
40	Westinghouse	MS	1800	1506800
40	General Electric	I-K	1200	181444
40	Westinghouse	MS	1200	1027421
50	Westinghouse	MS	1800	1289389
50	Westinghouse	MS	1200	854410
50	Westinghouse	CS	1800	2691183
50	General Electric	14	1800	181444
50	General Electric	KT-352	720	
50	Allis Chalmers		1800	3K28825
60	Reliance		1200	B11458
60	General Electric	I	1800	292596
60	Westinghouse	CCL	1800	329654
60	Robbins-Myers	K	1800	P515362
60	Triumph		1800	C14248
60	Westinghouse	CCL	1200	854121 (2200 v.)
100	Westinghouse	CCL	1800	1043213
100	Westinghouse	CCL	1800	765231 (2200 v.)
125	Westinghouse	CS	1200	2318625
150	Westinghouse	CS	1800	2429726
150	Westinghouse	CCL	900	438385
150	Westinghouse	CS	1200	4572596 (2200 v.)
150	General Electric	I-K	1200	
150	Westinghouse	CCL	720	808349 (2200 v.)
200	General Electric	I-K	900	232917 (2200 v.)
200	Westinghouse	CCL	900	919537 (2200 v.)
250	General Electric	I-K	600	2246834
300	General Electric	I-K	720	2357743
400	General Electric	I-K	900	2347845

SLIP RING MOTORS
3 phase, 60 cycle, 220/440 Volts

HP	Make	Type	RPM	Serial No.
20	Westinghouse	CW644C	675	8009992
20	General Electric	MT332	545	3889010
30	Westinghouse	HF	1745	4558408
40	Westinghouse	CW748	690	4406823
250	Allis Chalmers	3 bearing	505	104390 (2300 v.)
400	General Electric	I-M	900	224674
400	General Electric	I-M	900	246762

MAGNETIC CONTACTOR

400 HP. Gen. Elec. Type CR 7006. Form D12D. 3/60/440 Volts.

25 CYCLE GEARHEAD MOTORS

3—10 HP. Westinghouse Frame. 364. Enclosed 1500/378 RPM.
15 HP. Master Frame 405 Enclosed 1400/416 RPM.

WELDERS

1—300 AMP. Lincoln Shield Arc—60 cycle.
1—400 AMP. Lincoln Shield Arc—25 cycle.

SPECIAL

5—5 HP. Westinghouse Motors Nema Frame CSW. 284—Totally Enc., Fan Cooled Ball Bearing 3/60/220/440 volts, 1200 RPM.

FREQUENCY CHANGER

450 KVA. Westinghouse Synch. Generator, 25 cycle, 3 phase, 440 volts, 720 RPM., direct connected to 850 HP. West. Synch. Motor 60 cycle, 3 phase, 4160 volts, 720 RPM. With starting equipment and panels.

ERIE ELECTRIC CO., INC. 124 CHURCH ST. BUFFALO, N. Y. CL. 4758

IN STOCK FOR IMMEDIATE SHIPMENT

EXHAUSTING TYPE BLOWERS

340—Type 250-ELS American Industrial Fans. Inlet 10½"; Outlet 9⅞" x 8 9/16".

1—Type 350-ELS-B-1 American Industrial Fan. Inlet 14⅝"; Outlet 13⅞" x 11 15/16".

VOLUME TYPE BLOWERS

2—Buffalo Axial Flow Blowers, size 32; with built-in 15 HP Waqner Motor, 3-ph., 60-cy., 440-volts, 1750-rpm.

7—Size 4½, Type HS, American Fans. Inlet, double 28"; Outlet 27⅜" x 37⅜".

1—Size 5, Type HS, American Fan. Inlet, single 32"; Outlet 30 7/16" x 24¼".

1—Size 6½, Type HS, American Fan. Inlet, double 45⅞"; Outlet 55¾" x 40⅛".

62—Size 121-FM, Type ACF American Fans. Inlet 17"; Outlet 29" x 21½".

65—Type 350-A1 American Utility Blowers. Inlet 22"; Outlet 16¾" x 21⅜".

These Blowers are suitable for forced and induced draft service, heating, ventilating and air conditioning.

All Industrial Type "E" Exhausters are equipped with clean-out doors and rotating radiation and cooling shields.

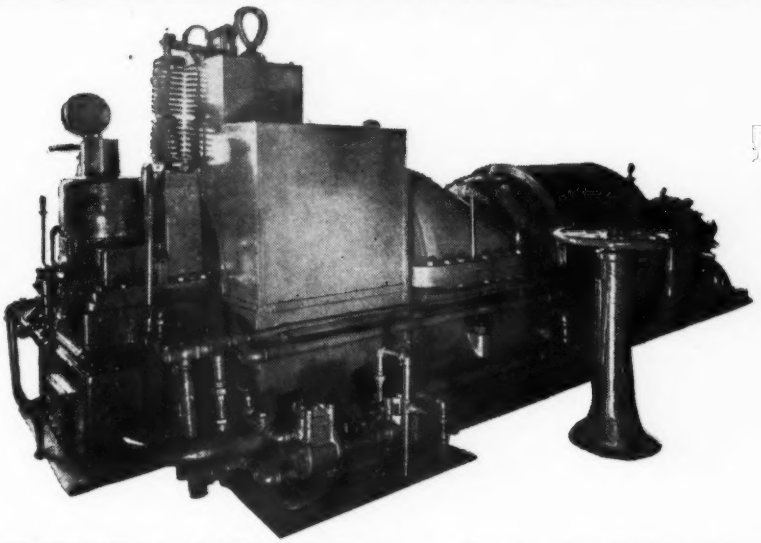
Units are completely reconditioned, cleaned, painted and guaranteed. Prices and operating data will be furnished upon request.

MORSE BROS. MACHINERY COMPANY

P. O. BOX 1708 DENVER 1, COLORADO

DEPENDABLE TURBINE-GENERATORS

IF UNIT Desired is Not Listed Send Us Your Specifications.



SPECIALS

7500-KVA, G.E.

1500 KW, G.E.

Write for Specifications Prices

WESTINGHOUSE 1000-KW, Aut. Extraction-Condensing Turbine-Generator

7500—KVA. G.E. Sur. Cond. 190 375#: 2300-v.
6250—KVA. G.E. Sur. Cond. 200 2300#-v.
5000—KVA. G.E. Sur. Cond. 200 400#: 2300 v.
3750—KVA. G.E. Sur. Cond. 200# 2300-v.
3125—KVA. G.E. Sur. Cond. 200# 2300-v.
2500—KVA. G.E. Sur. Cond. 200# 2300-v.
1565—KVA. G.E. Sur. Cond. 150# 2300
1250—KVA. Westinghouse, 200# 2300-v.
1250—KVA. West. Sur. Cond. 200# 2300
1250—KVA. Allis-C. Cond. 150# 480-v.
937—KVA. Allis-C. Cond. 200#.
937—KVA. G.E. 200# Cond. 2300-v.
625—KVA. G.E. 200# 2300-v.

WILMS, WEAVER & CO., 4045 Penobscot Bldg., Detroit, Mich.

STEAM TURBINE-GENERATOR ENGINEERS - TELEPHONE CADILLAC 1340-1

REBUILT POWER EQUIPMENT

READY TO SHIP!

SLIPRING MOTORS—3 PH., 60 Cy.

H.P.	Make	Volts	R.P.M.	Type
700	G.E.	2200	393	MT-432
400	Westg.	2200	435	CW
260	Burke	440	600	EMY-65
200	G.E.	220/440	1200	M-1
150	G.E.	220/440	1200	M-1
50-60	Westg.	220	1800	CW
50	Chandeys'n	220/440	1800	
50	West.	220/440	1120	HF
30	Westg.	220	1160	CW
20	Westg.	220	575	CW
15	G.E.	220/440	850	I
10	G.E.	220	1200	MTC-5201
7½	G.E.	220	1200	MTC

ALTERNATING CURRENT MOTORS 3 ph. 60 cy.

H.P.	Make	Volts	R.P.M.	Type
150	Wagner	440	1800	31V
100	Triumph	220/440	850	B-15
100	G.E.	220	1745	I
75	Westg.	220	1150	CS
75	West.	220/440	1800	M8
75	Triumph	220/440	685	B-15
60	West.	220/440	1800	CS
60	West.	220/440	1800	CS-T.E.
60	West.	220/440	1200	CS
60	Allis Chal.	220/440	1760	
50-32	G.E.	440	800-640	
50	Chandeys'n	220/440	1800	
50	West.	220/440	870	CS
40	West.	220	720	CS
30	Al. Chal.	220	870	
25	G.E.	220/440	1800	KT
15	Mutual	440	1200	MC144A
10	Westg.	440	850	CS

VARIABLE SPEED MOTORS—230 VOLT D.C.

H.P.	Make	R.P.M.	Type
100	West.	300-900	SK-191
100	Westg.	175-360-700	SK
75	West.	400-650	SK-181
30	G.E.	450-900	RIC
25	Westg.	600-1200	SK
20	West.	500-1500	SA
20	West.	750-1500	SK-110L
20	West.	625-1250	SA-6
20	Westg.	750-1500	SK-110L
15	Reliance	500-1800	
13	Westg.	500-1000	S-7
10	West.	400-1600	SA-7
10	G.E.	625-1250	LC
10	Westg.	565-1130	S-6
5	West.	400-800	SK-80
4	G.E.	850-1700	LC-8
3	G.E.	400-1200	RLC-114
3	Roth	500-1000	R8

SERIES WOUND MOTORS

H.P.	Make	Volts	R.P.M.	Type
175	G.E.	230	475	MD
100	G.E.	230	410	MD
85	Westg.	230	480	MCA 80
80	G.E.	230	500	MD-107
80	West.	230	400	76-A
50	G.E.	230	550	MD-106
50	Cr. Wh.	230	500	SM
35	Westg.	230	550	49D
32	G.E.	230	450	801
32	Shaw	230	485	5L2E
28	Westg.	230	395	904
25	West.	230	600	MT
15	West.	220	650	
10	Otis	230	1000	
15	Cr. Wh.	220	270	SM
10	West.	230	650	MT-00

230 VOLT DC MOTORS

H.P.	Make	R.P.M.	Type
100	West.	300	SK
85	West.	500	M
80	G.E.	500	MD107
75	G.E.	600	MP
75	West.	440	

TRANSFORMERS 1 ph. 60 Cy.

No.	Kva.	Pri	Sec.	Make
3	250	2300	460-230	Allis Chal.
3	250	6600/5940	2300	West.
2	150	2200-2300-2400	220-230-240	G.E.
3	125	2200	220-440	G.E.
3	112 5	2400	240/480	G.E.
3	100	2400	240/480	Allis Chal.
3	5	2300	220/440	G.E.
3	75	2400/4160Y	240/480	Allis Chal.
1	75	2400-4160Y	120-240	West.
4	75	2400	240/480	G.E.
3	75	240-4000Y	120/240	Allis Chal.
1	75	2400	240/480	G.E.
2	50	2200/1100	220/110	Maloney
2	50	2200	110/220	Packard
1	40	2300/115C	113/230	Maloney
1	40	1100/2200	110/220	Pittsburgh
3	40	2300/1100	220/110	West.
9	37½	2400	480/240	G.E.
1	25	2300	110/220	West.
2	20	2300/110	440/220/110	West.
1	20	2300	110/230	West.
2	20	1150/2300	115/230	Maloney
6	18	220	19½/38½	El. Furnace
3	15	2200	110/220	Cr. Wh.
3	15	2200	110/220	Packard
21	15	2290/1100	440/220/110	West.
58	7½	2200	110/220	G.E. & West
9	5	2200	110/220	G.E. & West

D.C. CLARK CONTROLLER

1—250 HP Clark Vari Time magneto controller 230 v. DC reversing, used for plugging service. Can also be used non-reversing.

MOTOR GENERATOR SETS—250 & 500 V. D.C.

1—100 KW 1200 rpm. 250 v. Westg. Gen. dir. con. to 220 v. 3 ph. 60 cy. Westg. Ind. Mtr.
2—75 KW 250 v. West. Gen. dir. con. 440 v. 3 ph. 60 cy. AC Motors.
1—60 KW 860 rpm. G.E. Gen. dir. con. to 75 HP 220/440 v. G.E. Mtr.
1—55 KW 1150 rpm. Westg. Gen. dir. con. to 85 HP 1150 rpm. 220/440 v. 3 ph. 60 cy. Westg. Mtr.
1—50 KW 250 v. DC Gen. dir. con. 220/440 v. 3 ph. 60 cy. AC Motor

INDUSTRIAL TRUCKS

9—Automatic type LO-5 Low Lift Trucks capacity 5 ton, platform type. Equipped with towing coupler and bumper for pushing cars.
10—New 4 ton Yale & Towne model Y8W Multi-Stroke Hand Lift Platform Trucks.

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Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

SLIP RING MOTORS
3-PH., 60 CY.

HP	Volts	Make	Speed
900	2300	G.E.	900
500	2300	G.E.	900
400	2300/440	Whse.	400
400	2300/440	G.E.	600
350	2300/440	G.E.	600
300	440	Al. Chal.	900
300	2200/440	G.E.	600
300	2200	G.E.	1800
250	2300	G.E.	600
250	440/550	G.E.	600
200	2200/440	G.E.	600
150	2200	G.E.	450
150	2200/440	G.E.	600
125	440/220	G.E.	1200
125	440/220	G.E. (Hoist)	900
100	220 440	G.E.	720
100	440/220	G.E. MTC	900
100	550	G.E.	900
100	2200	G.E.	900
100	2200	G.E.	1800
75	2200	Al. Chal. (new)	900
75	440/220	G.E. (MTC)	600
75	2200/440	G.E.	1200
50	2200/440	G.E.	600
75	550	G.E.	900
60	2200	G.E.	900
40	2200	Whse.	900
40	2200	G.E.	1200

SYNCHRONOUS MOTORS
3-PH., 60 CY.

300	440/220	Al Ch.	600
200	2200	Whse.	900
110	440	Whse.	900
100	2200/550	Al. Ch.	1800
100	440/220	G.E.	360
75	440 220	G.E.	720

OUTDOOR OIL CIRCUIT BREAKERS

1—New 400 Amp. Type FK, 136-1328A, General Elec. 3PST, 25,000 Volt Oil Switch, Interrupting Capacity 125,000 KVA, complete CT's PT's, etc.
3—NEW 400 amp., Type FKO 227, G. E., 7500 V., outdoor type, hand-operated.
1—3000 ampere, type FK 25, General Electric, 3 pst, 600 volt.

TRANSFORMERS
60 CYCLE

4—1250 kva, Al. Chal., 13800-460/230 V.
3— 833 kva. Whse., 11000-2300 V.
3— 500 kva, G.E., type H, form KS, 13800-230/460.
3— 333 kva., G.E., 66000-480 V.
1— 300 kva., Whse., 3 Ph., 13800-230 V.
3— 250 kva., Whse., 13,800-460.
3— 200 kva., Whse., 11000Y-2300 V.
3— 200 kva., G.E., 13200-480 V.
6— 200 kva., G.E., NEW PYRANOL, 2300-450 V.
2— 150 kva., G.E., type HTQ, 4150-240/480 V.
3— 150 kva., G.E., H-KDD 13200-2300.
3— 150 kva., G.E., H-KS, 2400-240/120 V.
3— 100 kva., G.E., type H 2400-240-480.
3— 100 kva., G.E., type H-KDD, 6900/11950V-230/115.
3— 100 kva., G.E., type H-KR 6600/11430V-2300 V.
3— 100 kva., G.E., H-KDD, 6600/11950-230/115 V.
3— 100 kva., G.E., H-KS, 2400-240/480 V.

TURBO-GENERATOR SET

1—112½ kva., 1200 rpm., 220/440 v., 3 ph., 60 cy., G.E., conn. to Terry, 3600 rpm., non-cond. turbine, 100/150 lbs. gu.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G	IK	1200
500	440/220	G.E.	IK	900
400	2300/440	Whse.	CS	720
300	440	Whse.	CS	450
250	2200/440	G.E.	IK	600
250	2200	G.E.	IK	450
200	440 220	G.E.	IK	1200
150	440 220	G.E.	KT	720
150(3)	440/220	G.E.	KT	1200
125	440	G.E.	K	514
125	440/220	G.E.	KT	1800
125	440/220	G.E.	KT (Vert.)	1800
100	440	G.E.	IK	450
100	2200	G.E.	KT	1800
100	440	Whse.	CS	1200
100	550	Cr. Wh.		720
100	550	G.E.	KT	900
74	2200	G.E.	KT	900
50	2200	Al. Chal.		720

MOTOR GENERATOR SETS

1—75 KW, 250 V, 850 RPM, conn. to 110 HP, 440/220 V. Sq. Cage Motor.
1—50 KW, 250 V. 850 RPM, Whse. conn. to 75 HP. 440/220 V. 3 ph. 60 cy. Sq. Cage Motor.
1—50 KW, 125 V., 1200 RPM, Whse. conn. to 75 H.P. 2200/220 V.; 3 ph., 60 cy., Sq. Cage Motor
1—35 KW, 125 V., 1800 RPM., G.E., conn. to 50 HP., 440/220 V., 60 cy., squirrel cage.

A.C. GENERATORS

1—375 kva, 514 rpm.480/240 V. G.E.
1—250 kva, 600 rpm, 440/220 V. Al. Ch.
1—200 KVA, 600 RPM, 4150/2300 V., Cr. Wh.
1— 96 kva, 360 rpm. 480/240 V. G.E.

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HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

2—4000 KVA. 60 Cy. 3 PH. TURBO WITH SURFACE COND.

1—3125 Kva. G.E. Turbo 230 V. 60 Cy. 3 ph.
100 KW. 550 V. 3600 Rev. 60 CY. 3 PH. turbo with exciter.
1500 CFM 2 STAGE AIR COMP. 275 HP. 60 CY. 2200 V. Syn. Motor Dr.
2—Cent. Pumps 4166 GPM, 162' Head, 1750 Rev.
1—36000 GPM. 27' or 25000 GPM 40' Hd. 285 Rev. Cent. Pump.
2—50 KW. 480 V. 60 CY. 3 PH. OIL ENGINE SETS.
1—187 KVA. 480 V. 60 CY. 3 PH. 225 Rev. Engine Set.
1—312 KVA. 480 V. 60 CY. 3 PH. 200 Rev. 4 Valve Rebuilt Eng. Set.
1500 and 2500 HP. 60 CY. A.C. Motors, 435 and 257 Rev.

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3— 667 KVA 6900/12000Y—2300 V.
3— 500 KVA 13200—2300 V.
3— 333 KVA 66000—480 V.
9— 75 KVA 33000—2400 V.
1—2500 KVA 26400/13200—460 V., 3-ph.

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5000 KVA GE 2300/4000 v. (bleeder)
3750 KVA GE 2300 v. Cond.
1560 KVA Wghse 480 v. (bleeder)
1556 KVA Al. Chal. 2300 v. Cond.
1250 KVA G.E. 2300 v. (bleeder)
937 KVA G.E. 2300 v. Cond.
750 KVA G.E. 2300 v. Cond.
625 KVA Wghse. 480 v. (bleeder)
625 KVA G.E. 2300 v. Cond.
625 KVA Ridge. 400 v. Non-Cond.
375 KVA G.E. 480 v. Cond.
375 KVA G.E. 2300 v. Non-Cond.
50 KVA Terry 480 v. Non-Cond.

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Two—310 HP Union Iron Works cross drum BOILERS; 175#; Detroit stokers; pumps, etc.

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625 KVA Skinner Uniflow
350 KVA G.E.-Ames
312 KVA G.E. Chuse Uniflow
187 KVA W.E.-Chuse 4 v.
187 KVA Wghse. -Ames Vertical Uniflow
166 KVA Al. Chal.-Ames

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1047 HP. (2) Heine 250#
758 HP. (2) Sterling 250#
500 HP. Heine; 200# (oil)
403 HP. Sterling 250#
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317 HP. (2) Heine 250#
310 HP (2) Union, 175#, cr. dr.
300 HP. Cleaver-Brooks; 125# (oil)
118 HP. B & W 160#

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375 KVA G.E. (2)-Worthington
225 KVA W.E.-Worthington
125 KVA W.E.-Worthington

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A. Ball Engine (Slide Valve) #4978 Wemco Generator. Direct Current 250 Kw 250 V 200 RPM
B. Ridgeway Engine Generator #3114, 28x32 Corliss Type. 400 KW 60/3/4000 V 150 RPM
C. Buckeye Engine #6337 Wemco Generator 400 KW 60/3/400 V 150 RPM

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2—300 KW GENERAL ELECTRIC ALTERNATORS, type ATB, form T, .80 P.F., 375 KVA 3/60/2300 volt, 3600 RPM, 94 Amps. Direct connected to: CURTIS TURBINES non-condensing, 175 lbs., type L-25"—2 stage, form C, serial #19177-19178.

STEAM GENERATOR SETS

1—50 KW Engberg Vertical 125 V., DC, 416 Amps., 300 RPM, 100 lbs. pressure, flywheel governor.
3—35 KW Sturtevant Vertical 125 V., DC, type VS7, 10 x 9, 100 lbs. pressure flywheel governor.
2—35 KW Westinghouse Turbines 125 volt DC, 100 lbs. pressure.

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Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

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50 KW—M. G. Syn. Set—440 AC to 250 DC.
500 KW—Westinghouse 240 V. Non-cond. turbine.
96 KW—240 Volt AC uniflow engine set.
375 KVA—480 Volt Ball 4-Valve engine set.
187 KVA—240 Volt Chuse 4-Valve engine set.
120 HP Fairbanks Morse Diesel engine.
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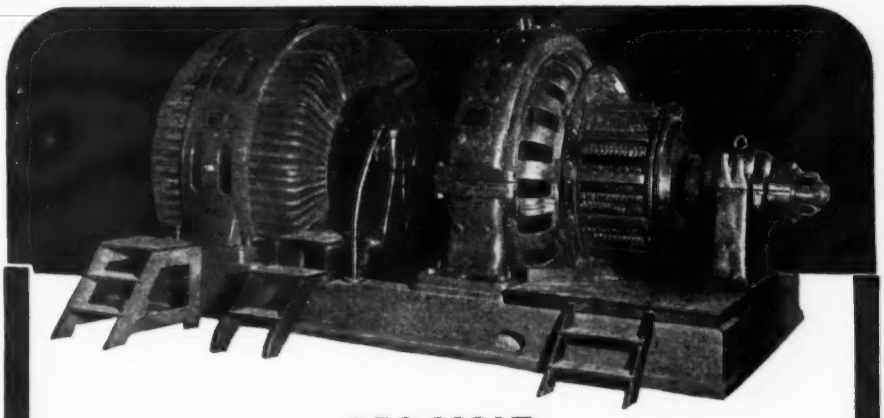

250 VOLT MOTOR GENERATORS

KW.	Make	Speed	Drive
500	GE	720	60 cy. syn.
400	GE	600	60 cy. syn.
400	GE	1200	60 cy. syn.
300	West	720	60 cy. syn.
200	GE	1200	60 cy. syn.
150	West	850	60 cy. sq. cg.
150	Al.-Ch.	500	25 cy. rot.
125	Hertner	1200	60 cy. syn.
100	GE	1200	3 wire 60 cy.
100	GE	750	25 cy. rot.
75	GE	1200	60 cy. syn.
50	West	1200	60 cy. sq. cg.
40	GE	1800	60 cy. syn.
25	GE	1800	60 cy. sq. cg.
15	GE	1200	60 cy. sq. cg.
15	GE	750	25 cy. sq. cg.
10	West	900	60 cy. sq. cg.
5	Rel.	1800	New VS
3	Rel.	1800	New VS

125 VOLT MOTOR GENERATOR SETS

KW.	Make	Speed	Drive
200	GE	750	25 cy. syn.
150	West	1200	60 cy. syn.
125		900	60 cy. slip
100	West	1200	60 cy. syn.
75	GE	1200	60 cy. sq.
75	GE	1200	60 cy. sq.
50	Sprague	900	60 cy. sq.
50	GE	750	25 cy. sq.
50	West	750	25 cy. sq.
35	West	750	25 cy. sq.
35	Sprague	750	25 cy. sq.
25	West	1800	60 cy. sq.
20	West		60 cy. sq.
12	GE	1800	60 cy. 3 wire
10	GE	1800	60 cy. 3 wire
5	Reliance	1800	new

Low Voltage and 125 V and 600 V Sets also in Stock

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1—440 HP Elec Machinery, 3-60-440V, 900 RPM, two bearing syn. motor

1—300 HP General Electric, 3 phase, 60 cycle, 440 volt, 360 RPM, type Mt 412 slip ring motor

1—275 HP Allis-Chalmers, 3 phase, 60 cycle, 440 volt, 1175 RPM slip ring motor

1—200 HP Westinghouse, 3-60-2200V, 600 RPM syn. #4956114, direct conn. exciter and starter

2—100 HP, General Electric, type 1-17, from K, 3-60-440V, 350 RPM

1—100 HP Westinghouse, type CCL, 3 ph. 60 cy., 2200 V. 1750, Sqirrel Cage

1—100 HP General Electric 3 ph. 60 cy. 4000V. 720 RPM syn., type TS with direct connected exciter

1—150 HP Allis-Chalmers 3-60-440V, 450 RPM slip ring

3—100 HP, General Electric, 3-60-440V, 450 RPM sq. cage

4—75 HP G. E. 3-60-2300V, 400 RPM, type I, sq. cage

1—75 HP General Electric, type KT, frame 562, 3-60-440V, 450 RPM

1—75 HP Fairbanks-Morse, type H, frame 105C, 3 ph, 60 cy, 550V, 900 RPM Squirrel Cage

1—75 HP Lincoln, type 1Q, 3 ph. 60 cy. 3 phase, 440V, 600 RPM Squirrel Cage

2—75 HP Fairbanks-Morse, 3 phase, 60 cycle, 2200 volt, 1800 RPM, slip ring motors

1—50 KW factory built m-g set, 125 Volt, Ideal 900 RPM driven by 75 HP, sq. cage 220/440 V. motor

1—60 HP, General Electric, 3-60-440V, 720 RPM, type I, form K

1—50 HP General Electric 3-60-220V, 1150 RPM, type I, slip ring

1—50 HP Triumph 3-60-440V, type C12 1150 RPM, slip ring, rotor & stator rewound

1—50 HP General Electric, 3-60-440V, 900 RPM, type I-M, slip ring

1—50 HP General Electric, 3-60-440V, 720 RPM, type IK, Sq. Cage

2—50 HP Allis-Chalmers, 3-60-440V, 720 RPM, slip ring

1—50 HP General Electric, 3-60-440V, 690 RPM, MT 546, slip ring

1—50 HP Wagner 3-60-440V, 495 RPM, type BM, Sq. Cage

1—50 HP Allis-Chalmers, 3-60-440V, 490 RPM, Sq. Cage

1—50 HP General Electric type 1-M, 3 ph. 60 cy. 440V, 720 RPM slip ring

1—45 KVA Fairbanks-Morse, 3 ph. 60 cy. 220 V, 1200 RPM alternator

2—30 HP Fairbanks-Morse, 3 ph. 60 cy. 2220V, 3600 RPM, type HO, frame 12B ball bearing

1—100 HP General Electric, type CD, fr. 123, 230V, 1200 RPM

2—75 HP Diehl, 230V, comp. interpole 700 RPM

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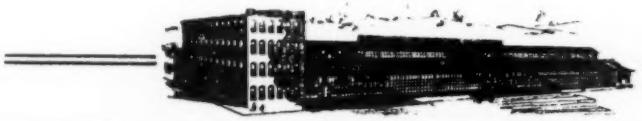

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2—1400 H.P. B. & W. 225-lb. Boilers
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3— 770 H.P. B. & W. Sterling Boilers 185#
3— 600 H.P. B. & W. 200# Boilers
2— 600 H.P. Edge Moor 200# Stokers
2—440 H.P. B. & W. Sectional 200# Oil Fired
4— 500 H.P. Heine 200 lb. Boilers
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3— 4000 K.W., G.E. Co., Turbo-Generator Condensing
2— 2500 K.W., G.E. Co., Turbo-Generator Condensing
2— 2000 K.W., G.E. Co., Turbo-Generator Condensing
1— 2000 K.W., W. E. & M. Co., Turbo-Generator Con.
2— 1000 K.W., G.E. Co., Turbo-Generator Condensing
2— 750 K.W., G.E. Co., Turbo-Generator Condensing
Several 500 KWs. & Smaller Units.

Non Condensing Turbos—300—500—750—and 1000 K. W. & Larger

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2—356 HP BABCOCK & WILCOX WATER TUBE BOILERS, VERTICAL STEEL HEADER—CROSS DRUM TYPE.

Each boiler set singly—17 tubes wide by 9 tubes high with a single steam drum 48" diameter by 11' 2-3/4" long.

A.S.M.E. Code — National Board — N. Y. Standard Built 1927 for 200 lbs. working pressure. One is gas fired, the other hand fired. Used for heating only, never over 15 lbs. press. Complete with grates, all trim and own supports.

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1—1250 KW General Electric Turbo-Generator, Type ATB, Form HT, 3600 RPM, direct-connected exciter, Wheeler Jet Condenser.

1—2000 KW General Electric Turbo-Generator, 180 lb. pressure, 3600 RPM Generator, Type ATB, 600 Volt AC, 2403 Amp. with Westinghouse-LeBlanc Jet Condenser.

1—1500 KW Westinghouse Turbo Generator with Surface Condenser 4200 sq. ft.

BOILERS

3—400 HP Casey Hedges Water Tube Boilers.

1—500 HP Casey Hedges Water Tube Boiler. Foster Superheater. These boilers are oil fired, system complete, automatic draft control equipment, etc.

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25 HP to 2100 HP **Boilers**—All types
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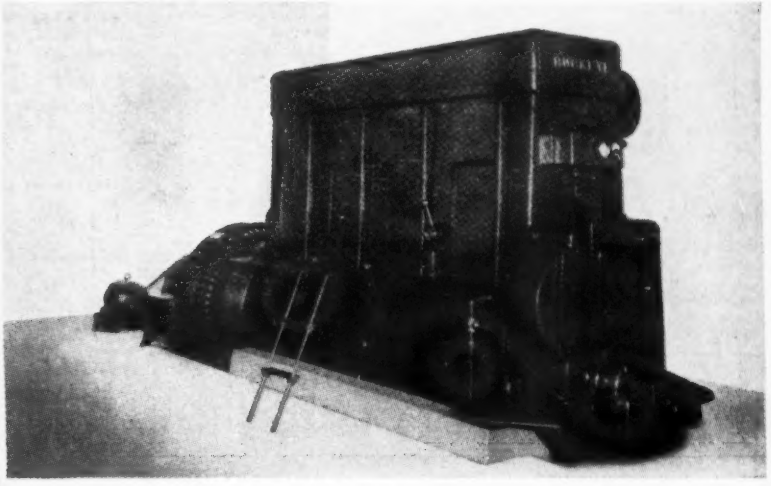

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Voltage will be corrected to your requirements

750 HP Enterprise	6 cyl.	600 KVA	3	60	2400	1938
750 HP Superior	8 cyl.	600 KVA	3	60	2400	1933
375 HP Alco	5 cyl.	372 KVA	3	60	240	1938
375 HP Fairbanks	5 cyl.	300 KVA	3	60	2400	1936
360 HP Fairbanks	6 cyl.	300 KVA	3	60	2400	1932
330 HP G. M. Winton	4 cyl.	282 KVA	3	60	240	1937
262 HP Buckeye	7 cyl.	219 KVA	3	60	2300	1938
225 HP Buckeye	6 cyl.	187 KVA	3	60	480	1941
187 HP Buckeye	5 cyl.	150 KVA	3	60	240	1937
240 HP Buckeye	3 cyl.	187 KVA	3	60	2300	1932
150 HP Buckeye	4 cyl.	125 KVA	3	60	480	1939
112 HP Buckeye	3 cyl.	94 KVA	3	60	240	1939

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D.C. GENERATORS, ALL VOLTAGES
CONTROL EQUIPMENT

ALL SIZES
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3 ph. 60 cy. A.C. Motors
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125 Volts D.C. Motors
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Put all idle equipment to work. Send your list for prompt action. **WRITE OR WIRE YOUR INQUIRIES**

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Induction Type—220 V.—2 Ph.—60 Cy.

1—5 H P. Burke—Type EB 5—1130 RPM.
1—5 H.P. Burke—Type EB 75—900 F P.M.
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1—10 H.P. Burke—Type EM 1.2—900 R.P.M.
2—20 H.P. Burke—Type EM 3—1200 R.P.M.
1—20 H.P. Crocker Wheeler—1170 R.P.M.
1—35 H.P. Burke—Type EM—4.5—900 R.P.M.
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1—150 H.P. West—Type CW—1765 R.P.M.
1—7½ H.P. totally enclosed—fan cooled—1200 R.P.M.

PUMPS

One Quimby 4 stage Centrifugal pump direct connected to 75 H.P. G.E. motor—220 volts—3 phase, 60 cycle, 1750 R.P.M.—500 G.P.M. 150 lbs. pressure.

One American Well 2 stage Centrifugal pump direct connected to 30 H.P. G.E. motor, 220 v., 3 ph., 60 cy., 1750 R.P.M. 200 ft. head complete with magnetic starter and safety switch.

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3—American Well Works; capacities 85, 165 and 200 g.p.m. with 10, 15 and 20 H.P. Motors; Current 220 volts, 3 phase, 60 cycle.

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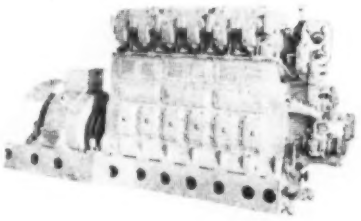

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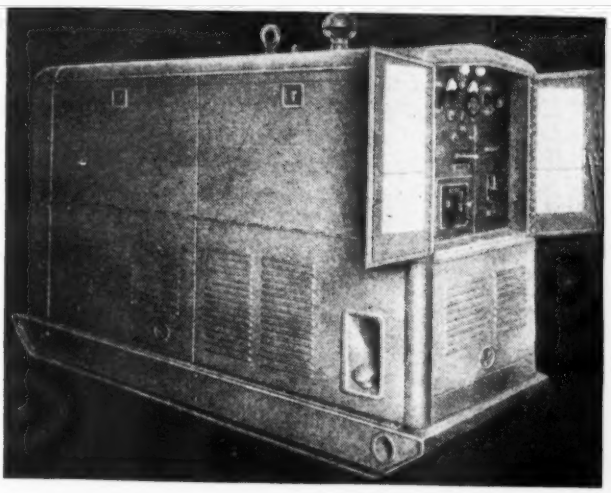

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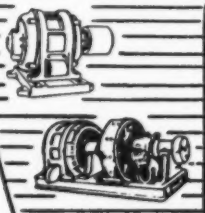

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Complete boiler plant consisting of 2—512 HP Casey Hedges 200# pressure; 1—650 HP Casey Hedges 225# pressure, with type E Stokers, individual stacks, forced draft fans, pumps, heater, all auxiliaries as a complete plant.

1—1392 HP Springfield sectional Header 400#.

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3—300 KVA Fairbanks-Morse Full Diesel Engines.
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200 KVA Generator, 440 volts, 3 phase, 60 cycle direct connected to 10 KW, 125 volts, 80 amp exciter. 360 RPM. Complete with bearings and switchboard.

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30 Ton Morgan 30' Span
30 Ton Morgan 77' Span
30 Ton Niles 53'9" Span
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30 Ton Reading 56' Span
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25 Ton Cleveland 106' Span
25 Ton P & H 70' Span
25 Ton Whiting 106' Span
25 Ton Whiting 82' Span
25 Ton Whiting 56' Span
20 Ton Alliance 77' Span
20 Ton Cleveland 65' Span
20 Ton Morgan 77' Span
20 Ton Northern 60' Span
20 Ton P & H 39'6" Span
20 Ton P & H 51'4" Span
20 Ton Shaw 76'4" Span
20 Ton Shepard Niles 49'6"
20 Ton Shaw 76'4" Span
15 Ton Alliance 50' Span
15 Ton Alliance 35' Span
15 Ton Cleveland 55'6"
15 Ton Cleveland 35' Span
15 Ton Morgan 77' Span
15 Ton Niles 32' Span
15 Ton Northern 53' Span
15 Ton Shaw 82' Span
15 Ton Shaw 77' Span
15 Ton Toledo 82' Span
15 Ton Whiting 74'8½"
15 Ton Whiting 71'10½"
12 Ton Morgan 56' Span
10 Ton Alliance 58'9" Span
10 Ton Alliance 71'10"
10 Ton "American" 27'
10 Ton Cleveland 38' Span
10 Ton Cleveland 50' Span
10 Ton Emsco 30' Span
10 Ton Lane 50' Span
10 Ton Morgan 39'5" Span
10 Ton Morgan 77' Span
10 Ton P & H 57' Span
10 Ton P & H 78' Span
10 Ton P & H 87'6" Span
10 Ton Northern 34' Span
10 Ton P & H 48'10½" Span
10 Ton P & H 60' Span
10 Ton P & H 80' Span
10 Ton Shaw 68' Span
10 Ton Shaw 58' Span
10 Ton Shaw 88' Span
10 Ton Northern 71'10½"
7½ Ton Erie 70' Span
7½ Ton P & H 30'6" Span
7½ Ton Scullin 71'10½"
7½ Ton Shepard 36' Span
6 Ton Shaw 23' Span
5 Ton "American" 10' Span
5 Ton Champion 37'6"
5 Ton Euclid
5 Ton Milwaukee 39'8"
5 Ton Milwaukee 66'9"
5 Ton Milkaukee 70' Span
5 Ton Northern 49'6" Span
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5 Ton Shaw-Box 35' Span
5 Ton Shepard 40' Span
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5 Ton Whiting 80' Span
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3. *500 HP BADENHAUSEN WATER TUBE BOILER;* 150 lbs. Pressure; Dutch Over Setting; 150 lbs. Pressure; Regular Trimmings.
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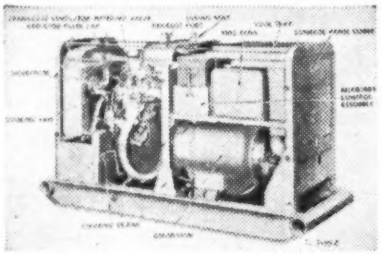

SACRIFICE—5 KW, 115-230 V., 3 wire, 60 cy., 1 ph. COST $1329.00.
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Kohler 1.5 KW, completely automatic, complete tools and spare parts. Export Packed.
ALSO 10-25-50 KW and 25 KW Diesel.

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Complete with separators, balancing coils and gen. panels (few switches and instruments missing) prices to sell. Write

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Coal Stoker Conveyor (New)

Capacity 12 Ton per hour at 30 ft. per minute. Complete with Head Shaft; Speed Reducer; Tex Rope Drive and one 2 H.P., 18 RPM, AC Motor. SACRIFICE.

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1—75 KW 125/250 volt 3 wire D.C. Westinghouse generator, driven by a 13½ x 13 Chuse 4 valve slide valve engine 275 r.p.m.
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Heine Boiler 360 HP, Code Stamped 167# pressure. Full trim. Hartford Insured. Immediate delivery. Missouri shipment.

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Holyoke, Massachusetts

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This is a medium grade paint which is ready to use and inexpensive. It produces a flat finish when brushed or sprayed on the surfaces to be protected. It is suitable for the great bulk of exterior maintenance painting where very high oil-content paints are not required. T-1215 may be used also as a first coater or undercoat over previously painted surfaces. It dries in a few hours. Write, wire or phone any of the War Assets Corporation Regional Offices below or mail this coupon.

SALE PRICE

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per gallon

Minimum sale 200 gals. of any one color, F.O.B. Location, subject to prior sale.

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Black
Dark Green
Loam
Olive Drab
Haze Gray
Field Drab
Earth Red
Earth Brown

In 5 gal. containers—some in 50 gal. drums

**T-1215 may be mixed in with linseed-oil-white-lead or other oil paints to obtain lighter shades or higher gloss.*

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COLORS

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Dark Green
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Earth Yellow
Black
Earth Brown
Loam ... Sand
Olive Drab
Earth Red

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388-1

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POWER

330 W. 42nd St. New York City

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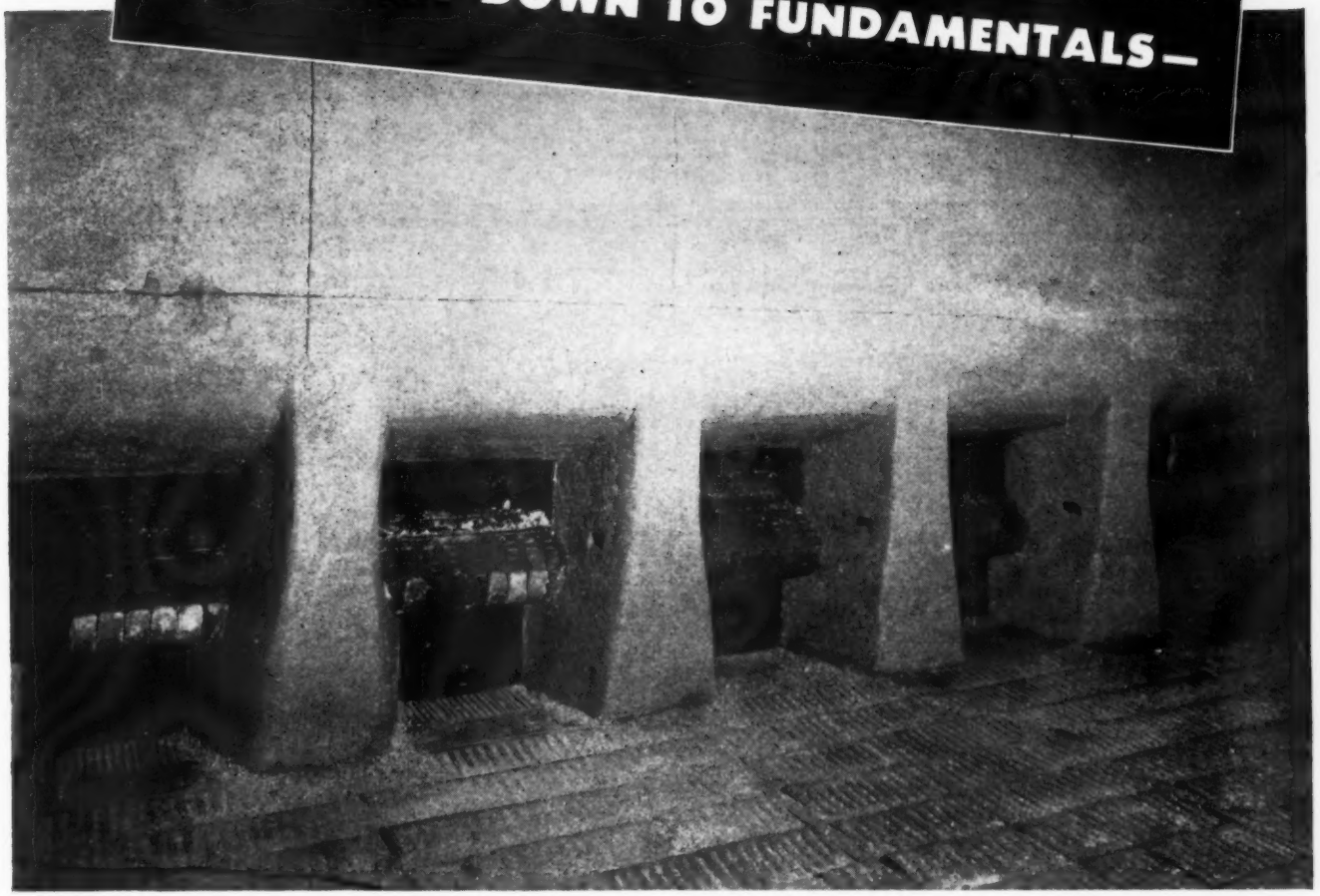

Plibrico piers and suspended arches in connection with Detroit Rotostoker under C-E boiler rated at 90,000 lbs. steam per hr.

LET'S forget for a moment the merit of Plibrico engineering and boiler setting service—important though it is—and go back to the fundamental advantage of Plibrico monolothic construction. In other words, let's look at those joints in laid-up fire brick—the joints that soon open up—that eventually spell the doom of a fire brick lining. It is these weak spots of laid-up linings that Plibrico Jointless Firebrick eliminates. It is on this fundamental advantage of jointless construction that Plibrico success is founded.

The use of highest-grade refractory in moist, plastic form lent itself to all furnace shapes—simplified the construction of arches and door openings—eliminated special tile shapes—proved the simplest and best way to build anything from a simple patch to a complicated lining. And Plibrico castable refractories brought the same advantages of monolithic construction and adaptability for sections beyond the firebox.

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PLIBRICO JOINTLESS FIREBRICK CO., 1818 North Kingsbury Street, (Dept. D), Chicago 14, Illinois

PLIBRICO *Jointless* FIREBRICK

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Here's Safety-Assuring Precision in Automatic PRESSURE CONTROL—

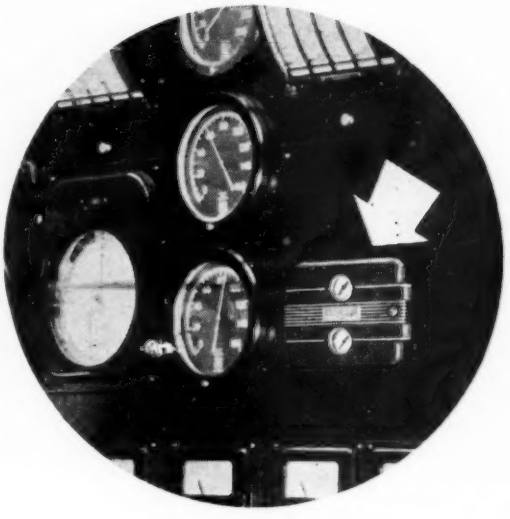
the extremely sensitive New

Swartwout Master Pressure Control

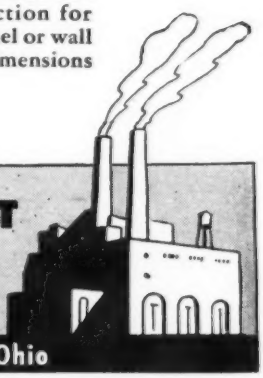
The safety you need for personnel, equipment and work in process requires dependable accuracy in controlling modern high pressures. Almost unbelievably sensitive in its reaction to pressure changes, the new Swartwout "P-2" Pressure Master Control acts instantly to hold forces to a narrow range through its control of regulating valves. It's a precision instrument of simple rugged construction. Requires but two adjustments. Handles problems of regulation of steam or other vapors and fluids. Assures stability of control for reducing, relief, spill-over, pump control and other functions.

Swartwout Type P-2 Pressure Master is compact, soundly engineered—is housed in a modern dust-proof case, easily accessible through front hinged door. It's a practical solution to many of your regulation problems.

Put your pressure regulation on a worry-free basis. Write today for Swartwout Data Unit No. S-203 describing the new P-2 Pressure Master Control.



Appropriate in appearance and suitable in construction for either instrument panel or wall mounting. Overall dimensions of door, 11¾ x 8½.



Swartwout POWER PLANT EQUIPMENT

THE SWARTWOUT COMPANY • 18511 Euclid Ave., Cleveland 12, Ohio

PRECISION THREADS

Rigidly clamped, the fitting is precision threaded by sharp taps.

....of Grinnell Pipe Fittings save installation and maintenance costs!

FEATURES OF GRINNELL FITTINGS

- Superior Metal
- Tested Strength
- Smooth Cores
- Uniform Wall Thickness
- Precision Threads
- Accurate Chamfer

The strict standards to which Grinnell manufactures every pipe fitting insure sharp, clean, precision-cut threads. This feature is demonstrated by the way Grinnell Pipe Fittings take hold, run up and tighten uniformly to make permanent, leak-proof joints. Precision threading machines operated by experts assure the maintenance of these high standards.

This is but one of the advantages you obtain – at no extra cost – by specifying Grinnell Pipe Fittings. They are the extra values that cut installation and maintenance costs. Identify these *good fittings* by the Grinnell "G" trade mark. Available through branch warehouses and jobbers everywhere. Write for Catalog 5-B. Grinnell Company, Inc., Executive Offices, Providence 1, R. I.

GRINNELL

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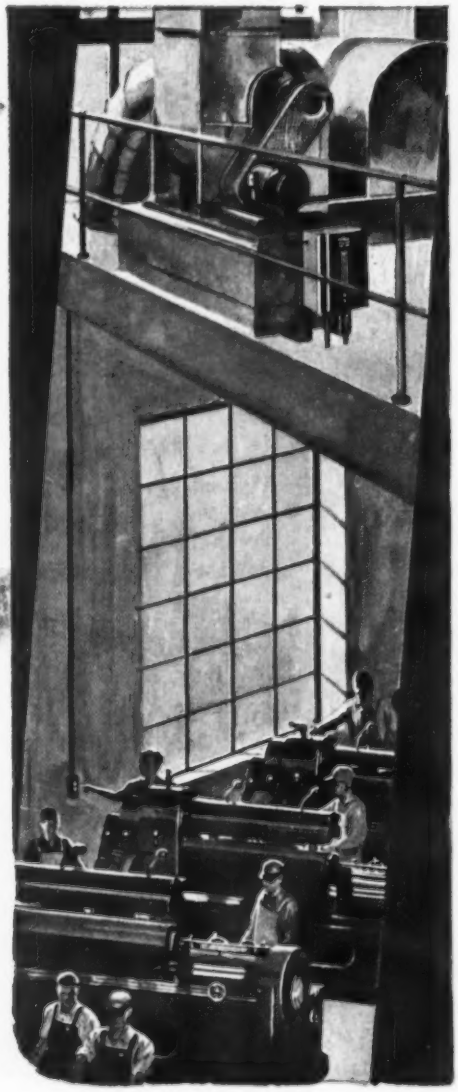
WHENEVER **PIPING** IS INVOLVED

Making Motors Hum . . . Your Tune

Remote Control

A Cutler-Hammer Magnetic Starter and its control station can be widely separated.



Multiple Control

A number of control stations can be used to save steps or provide greater safety.

Automatic Control

Limit switches, time switches, float or pressure switches allow automatic control.

How effectively any motor does its job, how dependably it serves, how long it lasts, are matters determined largely by the motor control that directs and protects it. Because this is true, thousands of factories specify Cutler-Hammer Motor Control and refuse to accept any substitute. They have found that Cutler-Hammer Magnetic Starters (Bulletin 9586) permit them to fit motors accurately to the needs of each job. Motor and control can be as near or as widely separated as desired. Control stations in multiple can be used to save steps or afford greater safety. Or automatic operations may be had by the use of time switches, limit switches, float or pressure switches, temperature controls, etc. But of greatest importance to the many users of Cutler-Hammer Magnetic Starters is the dependable trouble-free operation they assure . . . due to such famous engineering features as dust-safe vertical contacts and the eutectic alloy overload relay. Cutler-Hammer Magnetic Starters are the choice of the experts, recommended by the majority of all electric motor manufacturers, featured as standard equipment by leading machinery builders and carried in stock by recognized electrical wholesalers everywhere.

CUTLER-HAMMER
MOTOR CONTROL
C-H

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